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# OTHER LODE GOLD BELT OF CALIFORNIA

BY

CLARENCE A. LOGAN

BULLETIN No. 108

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# Mother Lode Gold Belt of California

By CLARENCE A. LOGAN

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## LETTER OF TRANSMITTAL

*To His Excellency,*
THE HONORABLE FRANK F. MERRIAM,
*Governor of California.*

SIR: I have the honor to herewith transmit Bulletin No. 108 of the Division of Mines, State Department of Natural Resources, on the subject of "Mother Lode Gold Belt of California."

In all of the important placer-gold producing districts of California in the 50's and 60's search was early begun to find the so-called "mother" vein or lode as the source from which the gold in the gravels had been derived by Nature's process of erosion. Success rewarded these searches in many places. One of the two most productive districts came to be known as the "Mother Lode Gold Belt," extending through the counties of El Dorado, Amador, Calaveras, Tuolumne and Mariposa. It is not a single vein or lode, but a zone or belt up to a mile wide for a distance of 120 miles from northwest to southeast, within which are separate and discontinuous veins of gold-bearing quartz.

This belt has been described and mapped in previous publications by both the California State Mining Bureau and the U. S. Geological Survey; and so great has been the demand and interest in these reports that none of them are any longer available for distribution and second-hand copies are at a premium. For this reason and to record recent developments the within bulletin is presented, which is the result of some six years of records researching as well as field examinations by Mr. Clarence A. Logan, district mining engineer, in the Sacramento office of the Division of Mines. It is accompanied by geological and claim maps. It is particularly opportune at this time of renewed and expanding economic interest in gold mining in California and the West.

Respectfully submitted.

GEORGE D. NORDENHOLT,
Director, State Department of Natural Resources.

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# INTRODUCTION

## Foreword

Of the numerous reports published upon the geology and mines of the Mother Lode, none have covered its entire length with sufficient detail. The first official report was that of Dr. John B. Trask, the first State Geologist, published in 1853. Others by the same author followed in the next three years. They describe a few of the principal mines.

The Second Geological Survey, headed by Professor J. D. Whitney, began work in 1861. His valuable contributions to science were halted in 1874 by refusal of the Legislature to allot more money for the survey, or to even approve printing results of the work of his staff; these books were later printed by Harvard University. From 1867 to 1876 the U. S. Commissioner of Mineral Statistics prepared reports of mine production. In 1880 the State Mining Bureau was established. From that time its reports have given a partial record of the State's mining industry, interrupted and restricted by lack or curtailment of funds and by changes in political policy. Notably, between 1896 and 1914, a period of great activity in the State's gold quartz and drift mining, only one small bulletin on quartz mines, that dealing with the Mother Lode, was published. During the period from 1880 to 1900 the U. S. Geological Survey mapped the principal gold mining regions of California in its geologic folios and covered the geology in some of the annual reports. The field covered was so large, however, that very little detailed treatment of individual mines was given.

Since 1914 the State Mining Bureau (now State Division of Mines) has published a fairly continuous record of the principal mining operations, but as is usual when changing legislatures must be depended on for funds, the appropriations, especially since 1922, have not been adequate to do justice to the industry. At present, everything published on the Mother Lode except a few of the later county chapters published by the State Division of Mines in Mining in California is out of print, including the recent excellent work by Knopf. The mass of information on the subject is therefore only obtainable piecemeal in the larger libraries; and even after perusing everything available there, the searcher will feel a lack of those details so much sought after by the mining investor looking for new fields.

The present bulletin is intended to supply such details as grade and character of ores, working costs and production figures. Some attention will be given to geologic factors which seem to have had a bearing on vein formation and ore deposition. It seems strange that in spite of the mass of published data on this lode, several of these factors have been ignored. The report will be an exposition of the actual results of mining and such value as it may prove to have will be due to the effort made to give the mining investor, engineer and mine manager those data so essential in forming judgments.

### Definition

The geologic aspects of the Mother Lode are so varied that only one definition, that based on geologic structure, is generally applicable to the entire lode. This may be stated as follows:

The Mother Lode is a belt of country from a few hundred feet to two miles wide, on the western slope of the Sierra Nevada, where the forces of mountain making, batholithic intrusion and subsequent adjustment in a great mountain system have led to extensive folding and faulting, of which the surface traces and shallower aspects follow lines of structurally weak rocks or contacts in most places. These structurally weak sections have been especially favorable for deposition of ore which has occurred as a result of repeated movements, and the incursions of mineralizing solutions.

In length, the Mother Lode has been proven by the finding of payable mines for a distance of 120 miles in a direction about parallel to the main axis of the Sierra Nevada, north of northwest. That the same geologic formations conspicuous on the Mother Lode continue on the strike northwest after being interrupted in Placer, Nevada and Yuba counties by outliers of a granitic batholith, has been noted by the present author in Butte and Yuba counties in mine workings where the surface is covered by andesite, but these limited exposures have not so far shown payable orebodies.

The distinguishing characteristics of the Mother Lode are uniform strike, north to northwest; uniform dip east or northeast at a rather steep angle, 50° to 80°, and association with certain rocks of slaty or schistose character, particularly Mariposa clay slate (Jurassic), altered andesites (in part Jurassic) and altered peridotite and serpentine all of which have been subjected to great compressive stresses or hydrothermal alteration along the distinct overthrust fault zone which has given access to mineralizing solutions from deep-seated sources (probably granitic batholiths) at the time of the great batholithic invasion of the upper crust when the Sierra Nevada were formed, in Cretaceous time. The term lode is particularly applicable to this vein system as most of the mines show two or three practically parallel veins, often with subordinate spurs, all occurring within generally definite walls, but with no vein traceable as a rule for any great length on the strike. See Plate I (in pocket).

### History

According to J. T. Wheeler, who was one of the original locators of the Granite State claim, quartz mining history on the Mother Lode in Amador County began with the location of the Original Amador Company's claims by Thomas Rickey on the north side of Amador Creek, followed by the location of the Spring Hill Mine on the south side of the same stream by two preachers named Herbert and Davidson. The location of the Granite State Company's and Pleasant Ridge Company's claims came next. At that time the size allowed by miners' rules for an individual's claim was 120 feet long by 60 feet wide. These locations were made in 1850; gold quartz had been found and worked in Mariposa County in 1849. Mexican arrastres were used for several months to crush selected ore, which, in the case of the Granite State, Wheeler reported as yielding $100 a ton. Several

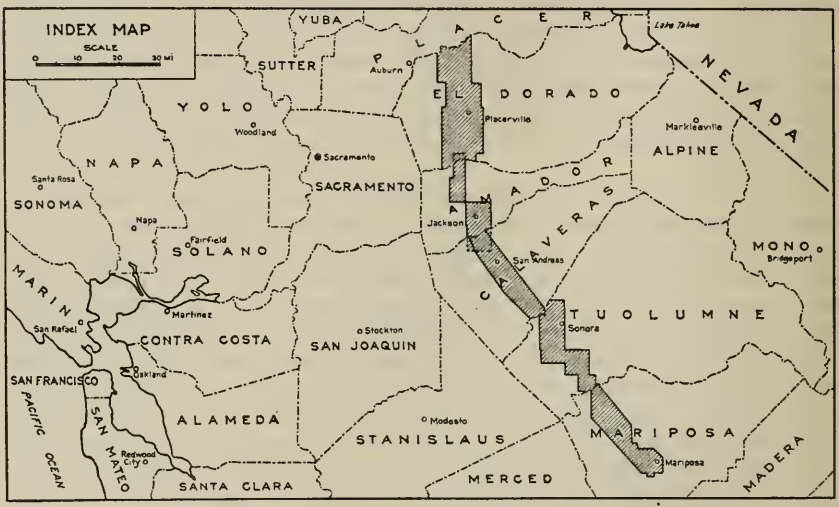
localities claim the honor of having the first stamp mill; in Mariposa County the Mariposa Mine had one in 1849 and in Amador County apparently the first was at the Spring Hill followed closely by an improved one of 12 stamps at the Granite State, for which the six owners gave a one-half interest in the mine in 1851. Mining had begun also on the lode in other counties in 1850.

In several localities the mining conditions were substantially similar, and the same evolution of mining and milling methods went forward. Mexicans built hundreds of arrastres which were used to crush selected ore, notably at Nashville and at the Union Mine in El Dorado County and at Carson Hill, Calaveras County. The amount of such bonanza ores was limited and the process was too slow and expensive to suit the Americans. With 150,000 white miners in the gold regions in the early 1850's, it is only natural that the crude stamp-mill known in the southern Appalachians should have been introduced in the different counties of the gold belt from Nevada County southward to Mariposa almost simultaneously. The first crude mills with wooden stems had much greater capacity than arrastres, but were in general failures. With few exceptions the quartz mines went into eclipse after a few years. The exceptions were those which had ores rich enough to pay with then-existing high costs, from $7.50 to $15 a ton.

One well-known engineer has stated his opinion that claims on the lode without ore-shoots outcropping at the surface are not likely to make valuable mines. As a matter of fact, nearly all of the largest and most profitable producers, including the mines at Angels Camp, the Kennedy, Old Eureka, Keystone, Plymouth Consolidated, Rawhide and Princeton were not profitable until depths of 100 feet or more had been reached, and many of them did not pay enough to keep running until sinking had reached several hundred feet, as in the case of the Utica. This mine and the Kennedy were worked intermittently for over 30 years before becoming consistently payable. The kernel of truth in the above-mentioned dictum is that a mine known to have paid well at the surface may be expected to repeat at lower levels; but the examples quoted are enough to show that no claim should be condemned solely for low surface assays.

The Mother Lode was a challenge to the courage and imagination of the bolder pioneer miners who saw the shallow placers being rapidly depleted before 1855. After the first set-backs which were shared alike by quartz miners at Grass Valley and on the Mother Lode, these men set about solving the problem of profitably working low-grade ores. The successful history of most of the Mother Lode mines is wrapped up closely with the lives of a few sturdy individuals, hard fighters and not too conscientious with those opposed to them, but generally men of their word. Such men as Alvinza Hayward, Senator Gwin, Colonel Nevills, C. D. Lane and W. F. Detert and their mine foremen and superintendents have left a record for the profitable working of low-grade ores which will tax the capacities of modern mining corporations to even approach. From 1865 to 1900 there were few to oppose the quartz miner and little in the way of embarrassing laws to hamper operation. On the other hand, the Mother Lode remained a pioneer country until 1900 or later. There were no railroads. Water

was freely available for power as long as the natural run-off lasted, but provisions for storage were limited or absent so that most mines had to close down from July or August until the first heavy rains, usually in December. They could of course use steam for power if grades of ore warranted, and many did, the last remaining steam hoists having been displaced only about 15 years ago. Wagon roads were abominable and became impassable with the first heavy rain so that it was necessary to lay in during the dry season nearly a year's supply of timber, powder, steel and other necessities. The quartz mines of this lode were the trial ground for many of the new processes, new machines and methods. The stamp-mill was steadily enlarged from a weight of 200 or 250 pounds per stamp to 1250 or 1500 pounds each. Frue and Johnston vanners were introduced about 1870–1875 and remained standard equipment to the almost complete exclusion of other concentrators as late as 1920. Dynamite was first




Index map, showing location of Mother Lode

used in 1868. This and the air drill had a great influence in increasing tonnage, lowering gold content of mill-heads and necessitating larger mill capacities. Electric power was first used for mine and mill operation in California in 1890 at the Dalmatia Mine, El Dorado County. Chlorination of sulphides was widely practiced until the introduction of the cyanide process in 1896; and a few chlorination plants were worked as late as 1915. Cyanide treatment was not as widely used as might have been expected; there were difficulties in its application to some ores, and the advent of railroads after 1900 and the building of pyritic smelters at San Francisco Bay led to shipment of much concentrate.

The cost of mine labor remained almost stationary on the Mother Lode from about 1870 until the World War—$50 to $60 a month with board in the early days became $2.25 to $3 a shift in later years as mine boarding houses were dispensed with and men moved to hotels in the nearby towns. The earlier miners were Americans for the

most part. Although Chinese miners were used in some drift placer mines and for surface work at quartz mines, they never liked deep quartz mining and did little of it. The Americans had been almost entirely superseded by Austrians, Montenegrins, Italians and other Southern Europeans before 1912. Up to the time of the late war, it was not uncommon to see only five or six Americans in an underground crew of 200 or more. The Europeans left during the war and lately the underground crews of some of the larger mines are mostly Mexicans.

Attendant conditions are now favorable for mining. Railways run directly to the lode in several places, and practically every mine is either on a lateral State highway or has a short road connecting with one. Electric power is available within short distances for most of the idle mines; all the active ones use it. Timber is abundant usually within a short truck-haul; some operators use "Oregon pine" (Douglas fir) for shaft sets. Ample water for milling is available in most sections. The elevation, ranging from 700 feet in southern Tuolumne County to slightly over 1800 feet in El Dorado County and 1932 feet at Mariposa insures fine climatic conditions, with only a little snow at the higher elevations.

As regards size of operations, depths reached and gross and net outputs, the mines of Amador County have been most important. The quartz ores in the Mariposa slates have been the most profitable. Vertical depths of a mile have been reached at the Kennedy and Argonaut, with the workings still in this slate. At some other mines, the ore channels have passed out of the slate at shallow depth into the greenstone or hydrothermally altered schists. 'Schist ore' or 'gray ore' has been found at a depth as great as 4850 feet on the dip but has not been mined to that depth. El Dorado and Mariposa counties have also had their best Mother Lode mines in the Mariposa slate, but depths less than one-half those in Amador have been reached. Present operations in these counties are in few places over 1000 feet deep. In Calaveras and Tuolumne counties the ores are almost entirely 'gray ore' or 'schist ore' though the Gwin Mine in northern Calaveras is in the typical Mariposa slate. The mines here range from a few hundred to 4000 feet deep, but few have exceeded 3000 feet.

The World War, by increasing material and labor costs, put most of the low-grade mines out of business. Just how serious this was, will be indicated by the comparison of tonnage and value of ores for a few years before and after the war. What may be called this state of suspended animation in quartz mining continued until 1929. In that year, gold production (which for some time had been coming mostly from a few dredging companies and half a dozen of the larger quartz mines) had dropped to only $8,526,703 the lowest for the State since 1848, and not much more than one-third of the 1915 output. A revival of interest in gold mining was manifest in 1930, and substantial improvement was indicated by an increase of nearly a million dollars production that year. This rate of gain was held during 1931 and 1932, in which latter year hand placer operations of 'depression miners' were credited with one-half the increase. The necessarily slower increase from quartz mining, due to the time needed in opening or rehabilitating the mines or increasing operations

in those already producing, showed in 1933 even before the price of gold was raised, in spite of recessions from other sources. The tendency to treat lower grade ore partly offsets the effect of higher gold price, so that added output is not a true index of increased activity.

Acknowledgment

The writer wishes to express appreciation of the courtesies extended by the managers and superintendents of the mines visited during the field work for this report. The other sources of information drawn upon have been so numerous that it would be difficult to give individual credit by footnote in every case, although the effort has been made to list all pertinent publications in the bibliography. The assistance received from the following men must be particularly mentioned: A. V. Udell, president and Byron Rowe, general superintendent, Pacific Mining Company; the late James Richards and J. C. Heald, for many years owners and operators of mines in El Dorado County; J. A. Norden, manager, and S. P. Holt, superintendent, Montezuma-Apex Mining Company; Wm. J. Loring, Robert J. Duncan, and T. S. O'Brien; E. A. Stent, managing director and Alex Ross, superintendent, Argonaut Mining Company; Albion S. Howe and James Spiers, former and present manager, respectively, Central Eureka Mining Company: E. S. McCurdy and A. C. Wilson of Utica Mining Company; O. A. McCraney, Stanley Arnot and A. D. Stevenot, former Mother Lode mine superintendents; Phil Cox, superintendent, Pine Tree and Josephine Mines, and James Kelly. Miss Helen M. Gaylord and Victor C. Heikes of the U. S. Bureau of Mines gave cordial assistance in obtaining gold production statistics and special thanks are due to that Bureau and to them.

## MINES

### EL DORADO COUNTY

#### Introduction

While the Mother Lode follows the Mariposa slates through the entire length of this county, there are marked variations in the characters of the numerous gold deposits along it. In the southern part of the county as far as the Church Union Mine on the north, the veins occur in the Mariposa slate area and share many features with the mines of Amador County. The slate belt is comparatively narrow and is flanked on the west, and for some distance on the east, by the diabase or amphibolite schist which seems to have had such an important influence on Amador's mines. Topographically, the lode here occupies a narrow stream valley for four miles where the North Fork of Cosumnes River has forsaken its usual westward course to follow the soft rocks.

Near the Church Union, a granitic intrusive has entered the footwall of the slate, which changes its course to northeast and begins to widen. From there north, the gold deposits are found largely in the igneous rocks which have intruded the slates, or in the contacts. These intrusives vary in character through the entire scale of increasing basicity from granitic to ultra-basic dikes which latter have yielded serpentine. The variations of these intrusives and the increased width of the Mariposa slate have given to the section a wider distribution and a greater variety of gold deposits than anywhere else on the lode. There are quartz veins in slate and schist, impregnations, dolomitic veins, pocket veins and seam deposits.

Mariposite and dolomitic rock are seen in mines near Placerville and Kelsey, and bring to mind the mines on the lode in Tuolumne County where serpentine is a wall rock. Beginning north of Placerville is a type of deposit called 'seam diggings' where gold occurs in quartz veinlets and seams in the decomposed schist of the greenstone dike series and in places in the slate. The soft, rotten upper portions of these deposits have been worked in many places, between Placerville and the Middle Fork of American River. Beginning near Garden Valley, a dike of amphibolite occupies the center of the Mariposa slate, which from here northward is split into two branches, one running north through Georgetown and Georgia Slide, the other northwest through Greenwood and Spanish Dry Diggings. Mining of the 'seam diggings' by the hydraulic process was carried on most actively near Garden Valley, Greenwood and Georgia Slide.

Mining on the Mother Lode in El Dorado County has nowhere reached such depths as in the counties to the south. The mines that have been worked successfully to the greatest depths have been those in the black Mariposa slate, as the Nashville, Montezuma, Church Union and Springfield. In some other mines where wide deposits were worked by open cut, probably the lowest operating costs for mining

and milling with white labor anywhere in California were achieved. Electricity appears to have had its first application here to the operation of mining and milling machinery in California. Many of the deposits in El Dorado County, in common with those of other counties on the lode, have been low-grade, and there has been little done with this type since 1915. But among the mines in the black slate are many which have produced in the past ore comparable in value to that taken from Amador's mines. Conditions unfavorable to gold mining generally in recent years have perhaps been the principal reason why the deeper levels of some of these mines have not been explored. For fifteen years the mines of El Dorado County have remained neglected by mining engineers and the better class of promoters. It can not be denied that a prejudice has grown up, which appears to be unwarranted, against the mines here. To this feeling must be added the fact that records of many companies have been lost or were destroyed in the San Francisco fire, so that tangible proofs of exact conditions underground are usually lacking. As a final unfavorable condition, it must be admitted that improper promotion methods and inadequate financing have hurt some prospects.

The present year is witnessing the reopening of several of these mines and there has been a resumption of prospecting all over the county which has led to the bringing in of a few new producers.

**Gold and Silver Production of El Dorado County, 1880–1933**

| Year | Gold, value | Silver, value | Year | Gold, value | Silver, value |
|---|---|---|---|---|---|
| 1880 | $389,383 | $208 | 1908 | 342,033 | 5,504 |
| 1881 | 550,000 | 900 | 1909 | 238,284 | 1,299 |
| 1882 | 600,000 | | 1910 | 171,304 | 967 |
| 1883 | 530,000 | | 1911 | 133,967 | 1,010 |
| 1884 | 575,000 | 16,000 | 1912 | 105,565 | 843 |
| 1885 | 35,000 | | 1913 | 62,688 | 250 |
| 1886 | 619,992 | 1,822 | 1914 | 133,886 | 654 |
| 1887 | 706,871 | 365 | 1915 | 401,288 | 1,353 |
| 1888 | 650,000 | 500 | 1916 | 361,821 | 1,496 |
| 1889 | 427,638 | 408 | 1917 | 24,758 | 85 |
| 1890 | 204,583 | 275 | 1918 | 28,352 | 722 |
| 1891 | 173,279 | 359 | 1919 | 30,121 | 279 |
| 1892 | 198,321 | | 1920 | 13,379 | 155 |
| 1893 | 294,610 | 1,220 | 1921 | 34,109 | 301 |
| 1894 | 366,707 | 356 | 1922 | 47,340 | 376 |
| 1895 | 700,101 | 448 | 1923 | 30,264 | 185 |
| 1896 | 812,289 | 534 | 1924 | 28,207 | 153 |
| 1897 | 674,626 | 886 | 1925 | 40,212 | 238 |
| 1898 | 501,966 | 4,174 | 1926 | 91,789 | 472 |
| 1899 | 404,497 | 8,414 | 1927 | 82,254 | 383 |
| 1900 | 368,541 | 25,129 | 1928 | 122,017 | 697 |
| 1901 | 292,036 | 5,977 | 1929 | 57,680 | 236 |
| 1902 | 335,031 | 52 | 1930 | 78,019 | 250 |
| 1903 | 277,304 | | 1931 | 85,322 | 283 |
| 1904 | 474,994 | | 1932 | 182,043 | 438 |
| 1905 | 384,735 | 2,525 | 1933 | 540,939 | 1,458 |
| 1906 | 431,746 | 2,690 | | | |
| 1907 | 319,177 | 2,301 | Total value | $15,766,078 | $95,838 |

The natural conditions and the facilities available favor cheap operation along the lode. A State highway traverses most of it, passing within a short distance of nearly all the mines and good branch roads are found everywhere. Electric power and water are generally available nearby, and lumber and timber are produced in

abundance in the mountains which are within easy trucking distance on the east. Placerville, Diamond Springs and Auburn are shipping points on the Southern Pacific Railroad, from which supplies and machinery can be delivered cheaply to the mines, the first two named places being directly on the Mother Lode. Many experienced American miners make their homes in the district, and the good roads permit driving to and from work, so that in many cases camps do not have to be maintained. Funds available can therefore be devoted almost entirely to actual prospecting, with a minimum of the incidental, preparatory and 'dead' work so necessary in remote sections.

#### Lode Mines

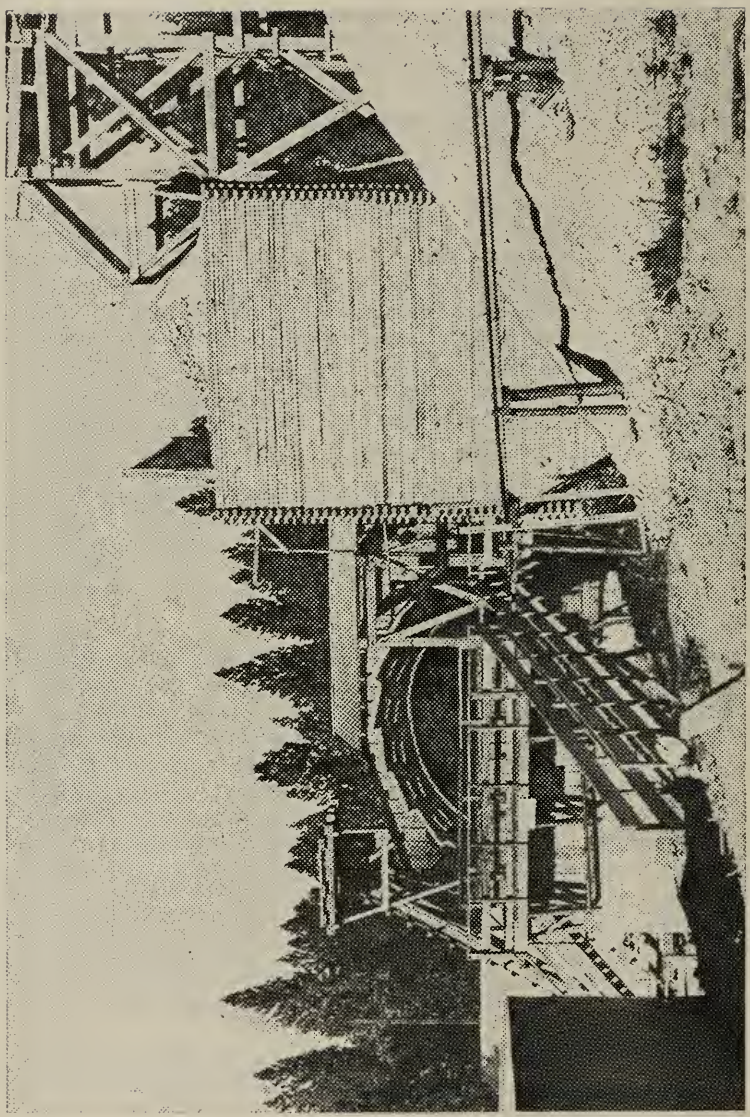
*Adams Gulch Mine* contains 40.68 acres two miles north of Nashville in Secs. 25 and 26, T. 9 N., R. 10 E. It was developed through adits by the former owner, J. C. Heald. Between 1902 and 1911 inclusive, small lots of ore were hauled from this place to another mill for crushing. The total yield during that time was $9,482.

The vein is reported to be about four feet wide in Mariposa slate. The adits were 180 and 220 ft. long. Nothing is known to have been done on the property since 1914. In 1931 it was one of several mines leased to J. S. Rex Cole, but no new work has been started on it.

*Adjuster Mine* is on Martinez Creek a short distance above the Union Mine. A crosscut adit was run years ago 250 ft. to the vein, and short drifts followed the vein less than 100 ft. each way, north and south. Both walls are Mariposa slate; the vein is reported to average 5 ft. wide, but could not be examined at time of visit, as the adit was in bad shape. There is an old mill of 10 light stamps, formerly operated by steam.

*Alpine Mine* in Secs. 15 and 16, T. 12 N., R. 10 E., is in the southerly part of the large amphibolite schist area which separates the Mariposa slate into two belts in northern El Dorado County. It was worked in the late 1860's through an adit and ore was crushed in an arrastre. By 1888, the Union Consolidated Company had reached a depth of 140 ft. and was running a 10-stamp mill. From then until 1902, the shaft was deepened to 300 ft. The vein was reached by crosscuts at 200-ft. and 300-ft. levels. Production stopped, so far as available records show, in 1902 when an output of $6,800 was reported. Some 10 or 12 years later the shaft was extended to 400 ft. in depth, and drifts were extended south on the vein or parallel to it on the three levels at 200, 300 and 400 ft. From a map, it appears that about 600 ft. in length was explored on the 200-ft. level; about 456 ft. on the 300-ft. level, and 475 ft. on 400-ft. level, with several hundred feet of crosscuts.

In 1933, this mine was taken over by Pacific Mining Company. Their work has been done on the 200-ft. and 300-ft. levels. The main vein, striking northwest and dipping 60° to 65° NE., was found to have been crossed by a series of faults dipping 25° S. According to Byron Rowe, general superintendent, three ore-shoots, each about 100 ft. long horizontally and up to 30 ft. thick have so far been found at these intersections. Former operators, who failed to appreciate the



Hadsell Mill at Beebe Mine, Georgetown.

*Courtesy of The Sacramento Bee.*

geologic conditions, ran drifts through these ore-shoots but in raising soon passed out of the flat-lying orebodies. Although the ore-shoots show a length of 100 ft. on the levels because of the flat pitch, the stope length is about 30 ft. The vein has two strands, most of the work being on the footwall section and to the south of the shaft. In 1934 a crew of 16 men was producing 75 tons a day. Ore is hauled by truck to the Beebe mill at Georgetown. It is white, sugary quartz with only about one-half of one per cent of sulphides. A mining cost of $2.19 a ton was reported early in 1934.

*Argonaut Mine* had a 10-stamp mill previous to 1890, but had produced principally from pockets. It lay idle thereafter until 1921. when it was made the subject of a questionable promotion called Golden Unit Mining Company. A Gibson mill was installed and a few tons of rock crushed is alleged to have yielded a little gold which was used to promote sale of units. No important new work was done. Later, in 1927, it was again the subject of a promotion, and 60 tons of low-grade rock was milled. In 1928, a small tonnage of rock yielded about $15 a ton.

The workings have been superficial, consisting of an adit 405 feet long giving a depth of 171 feet from the apex at time of last visit. The vein was exposed for a length of 110 feet and the face at the time was in amphibolite schist.

*Beebe Mine* is on a town lot at the north side of Georgetown; other land under agricultural patent, the Woodside, the Eureka and Eureka mill site claims adjoin and all are being operated by Pacific Mining Company, A. V. Udell, president, Crocker Building, San Francisco.

The Beebe was prospected about 1917 by Bulkley Wells to a depth of 250 ft. but remained unworked thereafter until 1931, when Alexander Wise took it over. Beebe Gold Mining Company, a Nevada corporation, was formed and a plant was erected containing two Hadsell mills and cyaniding equipment. Mining had been going on only a short time when Wise died and the property was shortly after taken over by the present operators.

The Beebe vein is a silicified and mineralized zone averaging 25 ft. wide but having a maximum width of 50 ft., in amphibolite schist. It appears to be very similar to the 'gray ore' of Amador. On the footwall of the ore zone there is a dike 10 inches to 2 ft. wide. There is reported to be only a commercial hanging wall, gold content gradually decreasing in that direction. The ore shoot was reported to have been opened for 600 ft. in length in June, 1934.

The Eureka vein is producing a somewhat higher average grade of ore than the latter. The Eureka claim was opened in early days and some work was done at intervals until 1908. The deeper shaft was sunk 235 or 240 ft. Levels called 85-ft. and 200-ft. levels were turned, and on the latter short drifts were run north and south. Another old shaft is reported 180 ft. deep. The present operators have extended the Beebe 250-ft. level under the Eureka and have sunk a winze to the 500-ft. level on the Eureka vein, and are drifting back from there to the Beebe vein. Ore had been stoped previously in the

Eureka to 130 ft. in depth but the output from this is not definitely known.

The Woodside claim in Georgetown was a producer of specimen ore in early days. It was opened to a depth of 210 ft. In 1867 it had

Open cut, Beebe Mine, Georgetown.

*Photo by C. A. Logan.*

a 5-stamp mill and had produced considerable 'high grade,' one wheelbarrow load of which was said to have yielded $12,000. By 1866 at a depth of 110 ft. the ore was showing so much sulphide that the owner had invented a concentrator made of "a sheet of India-rubber cloth 22 inches wide and about 8 feet long, sewed together at

the ends and stretched over two wooden rollers four inches in diameter and three feet apart." This was mounted with one end three inches higher than the other, was supplied with water through a pipe perforated with small holes, and dumped the sulphides into a box after passing the upper roller. Perhaps it was the parent of the vanners later used in such numbers. The only essential difference appears to be the lack of a shaking motion.

Considerable water was reported in the Woodside workings and this was given as the main reason for stopping work. Nothing has been done there in late years. The vein is reported to be two to three ft. wide, in slate, and to carry over $3 a ton in free gold, besides an unknown amount in the sulphide.

The Beebe mill, illustrated and described under Metallurgy (*post*) is of interest. A crew of about 45 men was employed at the Beebe and Eureka mines in June, 1934, and were producing and milling 325 tons a day or 7 tons per man-shift. This high efficiency results in a low mining cost, reported at $1.17 a ton early in 1934. This included overhead and general expense. The Beebe ore is a low grade, high-sulphide ore (see under Metallurgy) and only efficient and economical practice permits working it.

*Big Chunk* patented claim is one-half mile east of Kelsey on one of the veins in the hanging wall of the Mother Lode. It took its name from a large piece of 'specimen' quartz which contained $28,000 in gold and which was found in placer mining the bed of Big Chunk Ravine, a branch of Texas Ravine. This gold was supposed to have come from the Big Chunk vein at the head of the gulch. This vein has a width of about three feet at the surface and is of bluish quartz. It has been worked to a depth of 100 ft. by a shaft, and has an adit 150 ft. long, both caved. It produced a number of pockets beside the one mentioned.

*Big Four* joins the Isabel on the east and contains 16 acres in a nearly square piece covered by agricultural patent.

A vein which is 30 inches wide at the collar of the shaft, outcrops in the black Mariposa slate and strikes N. 10° W., dipping 55° E. A shaft has been sunk 96 ft. on the vein, with drifts 50 ft. long in each direction at the 50-ft. level, where an ore-shoot 75 ft. long is claimed. Forty tons of ore was reported to have yielded $10 a ton in free gold, and another lot of 50 tons produced $13 a ton, not including sulphides, regarding the amount and value of which nothing is known.

*Big Sandy Mine* is at Kelsey and is one claim 300 ft. by 1500 ft., patented. *Grey Eagle* claim adjoins on the north.

The claims are of historical interest, having been located by James W. Marshall when he moved to Kelsey. He did considerable work, especially on the Grey Eagle where he ran an adit which is still open.

The Big Sandy claim was a producer of low-grade ore for several years but lately has been worked only for pocket gold which has been produced by James Kelly, lessee. Occasionally very beautifully crystallized gold specimens are found. They resemble those taken out in Placer County near Forest Hill and at the Red Ledge Mine near Washington, Nevada County.

The low-grade ore was worked in an open cut 750 ft. long, 25 ft. to 30 ft. deep and 8 ft. to 15 ft. wide. James Kelly, former superintendent, states the ore averaged $1.75 to $2.25 a ton, in free gold and that about $66,000 was produced. A vertical shaft was sunk 340 ft. which cut the footwall vein of the Mother Lode at 240 ft. and again in the bottom, as the vein stands nearly vertical. On the 60-ft. level, a crosscut was run 60 ft. west and drifts were run 50 ft. north and 60 ft. south. On the 120-ft. level, the crosscut is 40 ft. long with drifts 15 ft. north and 80 ft. south. A rich stringer was found and a winze was sunk 40 ft. on it, when it was lost. Aside from this, the ore was low grade. The bottom of the shaft is said to be in ankerite two to three feet wide. On the surface near shaft, the footwall rock is an amphibolite schist dike, and the section across the claim shows in order going east, bands of porphyry (altered, obscure) soapstone and ankerite, talcose schist, vein matter 15 ft. wide composed of stringer leads of quartz and carbonates in altered schist, and Mariposa slate 50 ft. wide. The hanging wall of the vein has not been explored, but on the Harlow claim, 600 ft. east, there is a vein which has been slightly prospected.

The specimen gold lately produced came from surface workings south of the shaft, in seams crossing a thoroughly altered rock evidently a dike.

*Black Oak Mine* in the NE¼ of Sec. 34, T. 12 N., R. 10 E., near Garden Valley school, is one of the small mines which has been paying well during the past year. Previously it had been worked only as a pocket mine and had produced little. Edwin W. and Russell J. Wilson, a partnership, have recently been employing 18 to 20 men and have met with success after only a short period of operation and a moderate investment. It is a good example of how chance figures in mining. Neither partner had previous mining experience, and the property lies in a district peopled largely by pocket-hunters.

The amphibolite schist in which the deposit occurs is the southerly end of the large lens containing the Alpine Mine, which lies two miles north. Here the schist has narrowed to a width of only a few hundred feet. The vein and the schistosity of the schist both strike N. 20° W. and dip steeply northeast, the vein forming small quartz lenses up to 3 ft. wide. At the time of visit late in June, 1934, work was being done at a depth of 55 ft. Here the writer noted that a mud slip or bedding plane in the schist crosses the vein, striking N. 53° W. and dipping 37° NE. This mud slip is only one to three inches thick but it appears to have been the principal agent in localizing the deposition of gold. A length of 50 ft. along the strike of vein had been worked at the time, and the operators reported that the gold had been taken entirely from a depth of about three ft. directly under the slip. Still in the zone of surface oxidation, the ore carried mossy concentrations of free gold, at times rich enough for recovery by hand; some ore rich enough to ship to a smelter, and more of milling grade which was being trucked to the Hart mill near by for crushing. The mill ore varied from 2 to 10 ft. wide, extending into the schist walls on each side of quartz. This claim contains seven acres and the plant is very simple, with a small hoist, shop and compressor.

The same operators have a lease on the *Davenport* property containing 320 acres immediately south. The amphibolite schist traverses this land which contains a deposit similar to that at the Hart Mine (which see, *post,* under Seam Mines). In previous operations a series of open cuts and a crosscut 280 ft. long had been run. In the crosscut Russell Wilson reports that a width of 30 ft. gives assays high enough to permit mining at present. A width of 5 ft. was stoped 90 ft. long by 40 ft. high and is said to have yielded a fair return. A shaft was being sunk to further prospect the deposit in 1934.

*Blue Lead claim* joins the Big Four on the south and the Isabel on the east. At an early date, previous to 1867, this claim was opened to a depth of 250 ft. and an unknown amount of drifting was done. A 20-stamp mill was erected and a total outlay of $250,000 was said to have been made. The large dump indicates that the work must have been done entirely in the black Mariposa slate, with a large proportion of waste compared to the amount of ore handled. Although the workings yielded some fine specimens, it is said operations did not pay, and work had ceased before 1868.

*Chaparral or Golden Queen claim,* two miles southwest of Kelsey, was discovered in 1872 by Willets. From then until 1875 the property had a mill and was a small producer of ore reported to have yielded from $7 to $15 a ton. By 1875 the shaft, which had been sunk on the middle vein, was 150 ft. deep. The company then operating the mine was also trying to work the Gopher-Boulder mine but evidently lacked funds to carry on any new development. After taking out such ore as was available, they quit both properties. In 1901, the Golden Queen Mining Company was formed, but apparently did very little work on the mine. The shaft finally reached 200 ft. in depth.

The west vein on this claim has been only slightly prospected. Where it was mined, the middle vein was reported two to four feet wide. In depth, the footwall is said to be slate and hanging wall diorite; but workings have been inaccessible for years. It has been estimated that a lower adit 820 ft. long would tap the ore 195 ft. below the bottom of the old shaft. This distance might possibly be shortened because of the southward rake of the ore-shoot.

*Church Mine (El Dorado* or *Church Union)* was worked as a quartz mine first in 1886 and was 500 ft. deep in 1887. The ore-shoot was rich but not long, and the period of principal operations was about 13 years. Records of the company, like those of so many others, are said to have been destroyed in the San Francisco fire in 1906.

The principal work and production was from the middle or 'kidney' vein. In July, 1890, the ore is stated to have averaged $8 to $9 a ton in the 10-stamp mill; in August, $13; and in September, better than that, exclusive of sulphides. In 1894, a new 10-stamp mill was built which had a duty of 20 tons in 24 hours. The mine is in the Mariposa clay-slate.

The following notes are from a statement made to the writer by James Richards, who was superintendent of the mine for many years. There are no maps nor other exact details available.

"The main shaft was vertical and was 1200 ft. deep, in the footwall below 400-ft. level. There was a poor place in the mine between

350 and 500 ft., where the ledge cut out and we had only the gouge, then ore came in again. The vein below this averaged six feet wide, with the rich ore in the middle. The 600-ft. and 1200-ft. levels were run clear to the property line. The crosscut from shaft to vein on the 1200-ft. level was 670 ft. long and from this level we sank a winze on the vein to the 1400-ft. level. The ore milled down as far as the 1300-ft. level had averaged $17 a ton. At 1300-ft. the gouge came in, five to six feet wide; the ledge became so soft and broken that it could be shoveled. It carried about $4 a ton here. On the 1400-ft. level, we drifted 80 ft. The ground ran and swelled over night so that it could not be held with tight lagging. There was gouge on both walls.

"There was a great deal of $2 to $3 rock in the mine that should have been mixed with the rich ore to give a mill feed worth $6 to $7 a ton."

Sulphides formed 1½% to 2¼% of ore and assayed up to $140 a ton. The quartz made in lenses or kidneys up to 250 ft. long, but the best ore was said to be a chimney about 75 ft. long. To a depth of 300 ft., the mine made about 20,000 gallons of water in 24 hours, and later made 75,000 gallons daily when opened to 1350 ft.

It is the opinion of the present owner that the orebodies in both the Church mine and the Union or Springfield, were formed at the points where a side vein called the Klondike left the main lode wall and returned to it.

The east vein was worked in the Union (Springfield) mine just south of the Church. From different levels in the Church, prospecting was done on the west vein by running crosscuts during the operations described above. The mine was unwatered in 1900–1901 with the idea of checking up on the reported results of that previous work. There is no information regarding what was found, but work was not continued. The west vein, however, is known to be quite low grade.

*Bibliography:* Cal. State Min. Bur. VIII, p. 191; X, p. 171; XII, p. 106; XIII, p. 137.

*Cincinnati Mine,* four miles north of Kelsey, covers a stringer lead deposit in a decomposed dike in the Mariposa slate; it is not certain that the open cut from which the last rock was milled previous to time of visit in March, 1932, had reached the hanging wall, though a width of 10 feet had been cut. Older open cuts and shallow shafts extend south along the vein probably 600 ft. to the property line.

No record remains of the results of earlier work. In 1917 the claim was equipped with a light 5-stamp mill and the first clean-up early in 1918 is reported to have given an average return of $3.82 a ton by amalgamation alone. Later tests have given better results but no recent production has been reported.

*Coe Hill Mine* (*Gold Star* or *Bathurst*) is a mile south of Garden Valley. Shallow shafts have been sunk on several veins. Late in 1921, A. Tetrault and associates milled 50 tons from a dump and from an adit, which is reported to have plated $7 a ton. In 1925, Ed Bathurst, the owner, reported production of some $6 ore, and the next year a smaller lot of much higher grade, containing over an ounce of gold per ton. Since then, there has been no record of production.

A small 2-stamp mill was formerly operated. This property adjoins the Oro Fino.

*Crown Point and Gold Queen Consolidated.* These two patented claims cover 3000 ft. in length and 600 ft. in width along the Mariposa slate 2½ miles from Diamond Springs.

The Crown Point has a shaft 500 ft. deep which is intersected at a depth of 300 ft. by a drain tunnel 600 ft. long. The 400-ft. level was run 250 ft. along the east vein of the Mother Lode. This vein was 8 to 20 ft. wide. A crosscut was run from this level westward through the schist for 60 ft. to the west vein, which showed a thickness of 7 ft.; it was followed 50 ft. by drifting. Mill tests of quartz from both these veins are reported to have been satisfactory; but there is no written record of them available.

Another shaft was sunk 150 ft. south of the first, to a depth of 150 ft. Here the ore was reported in small lenses. Several small lots are said to have yielded $20 a ton or more. All of this work was done near the north end of the property. About 1000 ft. south some shallow shafts, tunnels and trenches have been run in search of pockets.

*Dalmatia Mine,* east of Kelsey on the hanging-wall side of the Mother Lode, has the distinction of being the first mine in California to employ electric power for the operation of mining and milling machinery. Hydroelectric power generated on Rock Creek was sent to the mine over a line one mile long and was first used in February, 1890, to run Huntington mills and other equipment.

The property before that had been known as the Kelly mine and a shaft had been sunk 260 ft. upon a vein two feet wide, crossing the main seam belt lode at an acute angle and producing ore which is said to have yielded $16 a ton. After the sale of the mine to an English company the preparations for working the low-grade orebody began with the driving of an adit 1200 ft. long to furnish an outlet for ore to be mined in a glory-hole above. While this adit was being run, a flat or 'blanket' seam was struck from which $14,000 in pocket gold was taken in two days. The main low-grade orebody was later mined by open pit, dropping ore through raises to the adit level, and crushing in Huntington mills.

Two miners working on contract mined the ore at a cost of only 7½ cents a ton as it was soft and very easily broken. It is believed that the cost of mining and milling here, which is claimed to have been only 43 cents to 56 cents a ton, set a low record that has not been surpassed in California. These operations extended from 1890 to 1894. An open cut about 500 ft. long averaging about 40 ft. wide and 80 ft. or more in depth was made. The gold occurred free in the seams and quartz stringers in the rotten amphibolite schist characteristic of the seam belt.

*Esperanza (Garden Valley) Claim* is one mile northwest of Garden Valley on a narrow dike of amphibolite schist altered from igneous rock that intruded the Mariposa slate or was contemporaneous with it. In 1890 the claim was being developed and was supposed to have a deposit of low-grade ore. A 20-stamp mill was erected and a sale made later to an English company. In 1898, after the shaft had been sunk

600 ft. vertically and 700 ft. of drifts had been run, this company crushed about 1000 tons of rock. Thereafter, they quit work and sold the machinery in 1900.

*Falls Mine.* Jos. Drechsler, owner. It is in the NE¼ of Sec. 1, T. 9 N., R. 10 E., mineral survey 5815. An adit has been run 235 ft. and the owner has been sluicing the surface to find the vein from which gold has come.

*Golden Gate (McNulty* or *Oakland) Mine.* This comprises two patented quartz claims and 40 acres of patented placer ground. It is reached from El Dorado and lies just south of the Springfield mine.

This was one of the older mines, having been located about 1852 by W. J. McNulty and having been worked before that by Spaniards and Mexicans using arrastres. It was formerly known as the McNulty. On the claim of that name a tunnel was run about 300 ft. to the vein giving backs of 200 ft. on the middle vein, and having been continued from there as a crosscut for 300 ft. farther in the direction of the east vein, which here shows immense outcrops on the surface. The tunnel was never completed as far as the east vein and it would be necessary to run it about 200 ft. farther to reach that vein. It is estimated that if this were done there would be about 500 ft. of backs above the tunnel on the east vein. Where this tunnel struck the middle vein an internal shaft was started and was sunk to a depth of 600 ft. Most of the ore was stoped out from this shaft below the tunnel for a length of about 300 ft. According to James Richards, who was formerly engineer of the property, this ore averaged $15 a ton in a 10-stamp mill then located on the mine. This vein had an average thickness of 4½ ft.

On the St. Louis mine, which lies east of the McNulty, the only work done has been three or four small shafts which show the east vein to have a width of from 8 to 12 ft. with assay values reported to run from $4 to $8 a ton. This was the vein toward which the tunnel from the McNulty was run.

*Gopher-Boulder Mine* is a mile and a half north-northwest of Kelsey and covered 3611 ft. in length along the lode as originally surveyed.

The Gopher mine proper was worked in 1858 when it produced $15,600 but the mill was removed before 1868. Ore was mined in two open pits and dropped through raises to a lower adit. Ore averaged $2.50 a ton and made in flat quartz stringers making into the main lode with a low dip to east. The open pits were 40 ft. wide. The upper tunnel followed a vein four feet wide for about 200 ft. This also was worked at an early date for a length of 120 ft. and 100 feet high and is supposed to have been rich, as pillars assayed $16 a ton. A lower tunnel 850 ft. long has a drift 150 ft. northwest on a vein four to five feet wide which has been stoped in places. A drift northwest struck and followed a flat vein of 'ribbon quartz' for 100 ft. It assayed $2 a ton for 50 ft. and $3.50 a ton for 50 ft.

A transverse gully crossing the line of the lode between the Gopher and Boulder workings indicates a fault, and this is confirmed by the relative positions of the workings which are on the hanging-wall side in the Gopher and on the footwall in the Boulder. The Gopher vein strikes N. 23° W. and the Boulder N. 11° W.

The Boulder vein is a large 'bull quartz' outcrop, 50 ft. wide at the Boulder shaft and in green amphibolite schist, showing mariposite. The shaft is an incline on an angle of 35°, 260 feet deep starting in the hanging wall, but the best pay was found near the footwall. Levels were run at 50-ft. intervals but no stoping was done below the 100-ft. level. The ore shoot was followed 130 ft. north and 120 ft. south from the shaft and was mined 7 ft. wide. Old records indicate it paid $6 a ton in free gold and show a production of $40,000 from it. On the 200-ft. level the ore shoot was lost, but 43 ft. north of the shaft ore assayed $3.10 and was followed 42 ft. and is said to have improved up to the face. In the 250-ft. level north the ledge was cut 35 ft. from the shaft on the footwall and is said to assay $3.30 a ton for a width of 7 ft. On the south in the 200-ft. level the ledge was cut but not followed, and on the 250-ft. level it appeared that the ore was pitching north.

Most of the work was done on the property before 1900, and ore was cheaply mined, and milled with 20 stamps and two Huntington mills. The company also operated the Dalmatia (which see) and was the first user of electric power to run mine machinery in the State.

In April, 1931, F. W. Grosjean had an option on the property and did some prospecting work on the surface, milling some low-grade schist in an old Huntington mill. Only the fine decomposed material was worked. The venture was short-lived.

*Griffith Consolidated* includes the Griffith and Bryant which is 2999 ft. long and 600 ft. wide and several other unpatented quartz claims giving the total length of about 4500 ft. along the course of the Mother Lode. The claims are a half mile southeast of Diamond Springs.

Most of the work has been done upon the Griffith and Bryant which formerly consisted of two claims. At the time of the original discovery a small shoot of very rich ore was taken from near the surface of the Bryant claim. This ground was worked in a small way for quite a long period during which time several shallow shafts and tunnels were run. The work begun by Griffith and Bryant in the fifties had been carried down to a depth of only 150 ft. when the Jumper Syndicate took the property about 1896. They sank the Griffith shaft to a depth of 700 ft. At the 350-ft. level the vein was 5 ft. wide and is said to have milled $8 a ton. The company was no doubt too hasty in putting a mill and other expensive equipment on the property before it had been well prospected. After fully equipping the claims and putting in electric power they continued sinking. At 500 ft. the vein was 12 ft. wide and was running with the schistosity of the slate. Under such conditions it was difficult to obtain clean ore and the ore taken out at that level was said to go $4.50 a ton or less on account of the large amount of wall rock jarred down by the heavy drills and blasts. The ore there contained about 3% of sulphides which assayed $36 a ton in gold. On the 350- and 500-ft. levels the work was done mostly north of the shaft prospecting a length of nearly 500 ft. along the vein.

The shaft was continued to the 700-ft. level and on that level on the north end it is stated that conditions began to improve as the vein began to cut at a slight angle across the schistosity of the slate and the walls hardened. When the 700-ft. level was reached an order was given

by the company to mine 2000 tons of ore and mill tests of this ore, according to the former superintendent, went $4.25 on the plates and 3% sulphides worth $42 a ton. The company closed the mine shortly thereafter and nothing has been done in those workings since.

About 1000 ft. north of this shaft the Klondike shaft has been sunk 150 ft. It is tapped at a depth of 100 ft. by the Klondike tunnel which is 300 ft. long and which follows the vein. The vein here shows in the form of small lenses from one foot to four feet in thickness. Two or three lots of ore from these workings milled from $20 to $65 a ton. A lot of about 100 tons taken out in 1903 is reported to have yielded $32 a ton, but there is no written record of this.

About 1200 ft. south of the Griffith shaft, No. 2 shaft was sunk 253 ft. In the bottom of this shaft it is said that the rock still assays well but is broken into stringers and frozen to the walls.

*Harmon Group* includes the *Van Hooker, Young Harmon, Old Harmon, Gross No. 1* and *No. 2* and *Eureka* patented claims on the Mother Lode just north of Placerville.

The work at time of visit was mostly on the Van Hooker claim, where an old adit was reopened and extended, having a total length of 1200 ft. from portal to north face at time of visit, and giving a vertical depth of 200 ft. on the vein. The ore occurs as a stringer lead and lenses of quartz in Mariposa clay slate, both having been greatly crushed by movement along the course of the vein, which has a width of from 2 to 12 ft. A pay shoot 50 ft. long had been stoped and raised upon to a height of 80 ft. and for an average thickness of 5 ft., at time of visit. The best ore shows pyrite, galena and coarse free gold. The ore that had been milled up to that time had yielded $7.25 to $27 a ton. Production began in 1928, and continued for three years.

Further prospecting has since been done on the north, where the adit level was turned to follow the vein, but new orebodies had not been found at time of last visit. A winze was also being sunk from adit level late in 1931.

There is a mill of 10 light stamps and one concentrator, capacity 24 tons daily. Electric power is used to run the mill and air compressor.

At the *Old Harmon*, a new collar was put on the shaft, which was 560 ft. deep in 1931, preparatory to reopening it to 115 ft., where a prospect was claimed. The mine produced considerable gold (some estimates being as high as $250,000) during early operations. It was worked between 1870 and 1890, having been a part of the True Consolidated Mining and Milling Company's holdings, which were developed by a long adit in 1887 and 1888, running the length of the Harmon claims. About 1895 these claims passed into the hands of Placerville Gold Mining Company and little has been done on them since. Nothing was done in 1931 below the surface.

The vein running through the Old Harmon and Young Harmon claims averages 15 ft. wide and in places is 45 ft. to 70 ft. wide, occurring as stringers in slate.

*Bibliography:* Calif. St. Min. Bur. R. VIII, pp. 180–191; XII, p. 125.

*Havilah (Nashville) Mine,* at Nashville is said by early authors to have been the first quartz mine worked in California; but elsewhere[1] it is stated that it was the first one worked in El Dorado County (1851), and is credited with an output of $150,000 from surface and shallow ore, first worked in arrastres. "The first systematic work" was done in 1868 and the same authority states that "in three years the mine paid for all of its development work, and plant costing $100,000 and paid $50,000 dividends" from ore yielding $3 to $15 a ton. Litigation closed it in 1871; Joshua Hendy obtained a patent in 1880 and by 1882 had sunk the shaft to a depth of 642 ft., the ore from the last 100 ft. of shaft being reported as yielding an average of $8.50 a ton. After producing $45,500 the Hendy interests quit. The mine then lay idle until 1894, when a 20-stamp mill was erected and during 1895 and 1896, G. E. Williams and Hendy produced $20,000 from ore mined between the 500-ft. and 600-ft. levels.

No further work was done until 1903. Between then and August, 1906, the shaft was sunk to the 1200 ft. level with drifts 500 ft. south and 1285 ft. north from the shaft crosscut on that level. The north drift explored the vein under the Montezuma Mine, where a short ore-shoot was found. At that time it was equipped with a good plant including a 20-stamp mill. The only production figures at hand for this period were for 1904, when the shaft was 1000 ft. deep, and when 4000 tons yielded $15,325. If there was production in 1905 and 1906, the separate figures for this mine are not available as it was being operated jointly with the Montezuma, and the later work through the Havilah shaft was in the Montezuma. Although the mine was under option in 1913-1914 with the Montezuma, no further work was done until the present year, except the milling of part of the dump, which yielded $2 a ton or more. At present, the property is being reopened by Montezuma-Apex Mining Company, who are also operating the Montezuma Mine, adjoining on the north. The Havilah shaft has been reopened and during the past summer the milling of ore from the upper levels was started.

Geologically, the Havilah is similar to the Montezuma, with the same vein in black Mariposa slate walls. The maximum width of vein is 20 ft. but it averages about 5 ft. wide, and in the new work on the 200-ft. level was being mined 6 ft. wide in June, 1934. The former operators had stoped for a length of 100 ft. there on the south side of the shaft. The present company was carrying on stoping there in June for an additional length of 80 ft.

*Hines-Gilbert Mine* is 20 miles from Auburn via Spanish Dry Diggings, the last mile being steep trail. The five claims lie partly in El Dorado and partly in Placer County in the steep canyon of Middle Fork of American River, but recent work has been in El Dorado County.

Two veins occur between Mariposa slate and amphibolite schist, where the slate belt is split by intrusives or interlayered extrusives. The slate bodies here are comparatively small. The hanging-wall vein has been traced about 400 feet on the surface. It strikes N. 20° W. and dips 80° NE. The development work on it consists of short adits and

[1] California Mines and Minerals: Cal. Miners' Assoc., 1899, p. 310.

open-cuts, mostly superficial. This vein averages five to six feet wide and the unoxidized ore is reported to assay well. A crosscut was run to the footwall vein from near the river level, but this had caved and was inaccessible at time of visit. The veins are about 200 ft. apart.

By 1924, one adit had been driven 450 ft. giving a depth of 110 ft., and small tonnages of good-grade ore were produced annually from 1921 to 1924 inclusive. In 1925, ore was low grade, but in 1928 improved again. Since then there has been no production. The output since 1921, less than 2000 tons in all, has varied from $3 to $40 a ton recovered.

The property has a 10-stamp mill, a 3-drill compressor, etc., operated by water power, using water from Canyon Creek, under 600 ft. fall. Work was resumed in 1934.

*Ida Livingstone* patented claim one mile north of Kelsey has a vein striking N. 50° E. and dipping 80° east at the main shaft, between hard slate walls. For a distance of about 400 ft. on the north end, the vein outcrops as a solid body of white quartz reaching a width of 25 ft. or more, and with little sign of mineralization. An old shaft on the north is of unknown depth, probably less than 100 ft. The south or main shaft was 150 ft. deep, in the creek where water caused trouble. An ore shoot 50 ft. long on top tapered to a length of 10 ft. and thickness of only six inches at the bottom. It paid $26 a ton in a custom mill.

*Isabel claim* in the Garden Valley district, is traversed by a vein striking N. 30° W. to N. 45° W. and from 2 ft. to 8 ft. or more in width. The vein was worked to only a few feet in depth for a length of several hundred feet, and rock was crushed in arrastres at first and later in the mill on the Blue Lead, adjoining (which see). Reported value of ore, $3 a ton on north end on hanging wall side. The vein is in black slate in the shaft which was probably not over 30 ft. deep and was the deepest working on the claim.

*Joseph Skinner (Fisk) Mine* adjoins the Lemon claim on the south. It is one of several small claims known as seam mines and pocket producers, and is on the east or hanging wall side of the main lode. The dip of formations here is nearly vertical and steeply west, probably due to hillside drag. In earlier days the surface was hydraulicked. Later workings are reached through a cross-cut 90 feet deep at the face, and running west 232 feet, from which drifting had progressed 76 feet north when visited. On the west of vein, a crosscut shows ankerite to be at least 60 feet thick. Strips of altered gray dike-rock alternate with the black Mariposa slate across the north face. On the east side of fissure a dike 18 inches wide is succeeded by 6 inches of slate full of pyrite; the latter is followed by 11 inches of dike rock. Gold was observed to occur in a quartz seam in the dike where the quartz comes in contact with the lower (east) side of the slate. Three men were taking out a little specimen ore when visited in 1932.

The Skinner and Lemon claims together were credited with a production of $80,000 before 1897 from a length of 1700 feet. In a few months in 1897 and 1898 a further output of $10,000 was reported from the claims, then known as the Empress Josephine Mine. Again, in the period 1901–1903, nearly $9,000 was produced. Most of the yield was from specimen ore, though some small lots were milled.

*Kelly Mine.* Miss Margaret Kelly, owner. This prospect is on the hanging wall side of the Mother Lode, on the Kelly Ranch one-half mile north of Kelsey. It is in the Mariposa slate. A heavy vein of quartz outcrops here.

Thirty years ago shallow shafts were sunk, probably in search of pockets, but no ore was milled. In 1932, one shaft was cleaned out and extended and another was sunk, both having depths of 50 ft. at time of visit. They are 150 ft. apart, and both on the vein. In the north shaft, vein is over 6 ft. wide, striking nearly due north while the schistosity of slate strikes N. 15° W. In short drifts from the bottom of south shaft, the vein increased from a width of six inches on the north to four feet on the south in a distance of 33 ft. A flat seam of quartz 10 inches wide enters here from the west, and may be connected with the formation of ore. After favorable assays were had, a small mill run was made, but results were vitiated by a mill accident, and work has since been suspended. The gold is very fine, but the prospect appears to have some promise.

*Kelsey Gold* and *Silver Mine* is six miles north of Placerville and was prospected many years ago. Kelsey Mining Company, Incorporated, was formed in 1926 to reopen it. An old adit was cleared and has since been extended, having a length at present of 1700 feet, following the vein north to N. 32° W. Several footwall crosscuts have also been run.

The claims, which extend for nearly a mile along the contact of narrow dikes of amphibolite schist and serpentine with the enclosing Mariposa slates, show the characteristic ankerite and grey schist ores which appear everywhere on the Mother Lode where these formations occur. A cross section of formations from west to east, shows a schist footwall, six inches of mixed carbonates, 8 ft. of grey schist mineralized with quartz, pyrite and galena, forming low-grade ore in places; then 6 ft. of slate 'ribbon rock,' containing much pyrite and some galena; and the black Mariposa slate hanging-wall. Within this lode zone, the formations have been much disturbed by faulting. Another section exposed by crosscuts shows a total width of 46 ft. with the footwall and hanging wall veins as mentioned above.

The company put up a second-hand 10-stamp mill with two Wilfley tables in 1928. Some oxidized 'gray ore' from the ankerite zone near the adit portal yielded coarse free gold but this was in only small amount. Beginning about 800 ft. from the adit portal, stoping was carried on at intervals for a length of 320 ft. and to a height of 30 to 50 ft. above the adit. In the four years from 1928 to 1931, inclusive, about 15,000 tons was crushed and yielded average returns from $1.80 to $6.40 a ton. This was mostly from the footwall vein. During the next two years, little work was done.

Early in 1934, C. T. Palladine became superintendent and activity was resumed. In June, 20 men were employed. Numerous surface improvements were made, including changes and additions in the milling plant, which was altered to handle ore by flotation, retaining the stamps for intermediate crushing. The flow sheet as it stood June 28, 1934, is illustrated under Metallurgy, *post*. Milling had not been started at that time.

*Larkin Mine,* one mile east of Diamond Springs had been opened to a depth of 250 ft. by 1896 and had three levels. It was a producer until 1903, first having 5 stamps and later 10. The shaft was sunk 800 ft. vertically. The footwall is schist; the vein worked is in the hanging wall of a wide ankerite vein or zone, similar to those so common in El Dorado and Tuolumne counties. The vein and accompanying altered igneous rocks are in the Mariposa slate east of the great intrusion of granitic rocks which here has displaced the slates so that the veins strike north or northeast. The principal productive vein was from 4 to 12 ft. wide, contained 1½% of concentrate and the meager figures available indicate a yield of $5 a ton in the later work. A 'west vein' was prospected on the 400-ft. level and was reported 7 ft. wide. The total production was estimated by C. H. Dunton, former superintendent, to have been about $125,000.

*Lookout Mine,* in the Mariposa slate one-half mile southwest of the Union Mine, was located about 1860 and has been worked intermittently in a small way since. It has been a small producer of gold pockets. Since 1912, when a production of over $2,200 was reported, there had been no recorded output until early in March, 1933, when Arthur Seymour, lessee, reported a production of $15,000. The mine has been worked through an adit over 600 feet long. Seymour reported the strike was made in the roof of the adit, where a raise was started 520 feet from the portal, and 270 feet below the surface.

*Lucky Marion Mine,* a mile west of Greenwood, occupies part of the contact of a dike of serpentine with the Calaveras formation. It was worked in 1896 and 1897, and had an incline shaft 112 ft. deep and a 20-stamp mill. From 1897 to September, 1899, it was shut down on account of litigation. Thereafter, in 1901, it produced $3,860. No tonnage figures are available, but the ore is believed to have been 'high-grade' from a greenish quartz stringer 18 inches to 2 ft. wide. There is no further record of production.

*Martinez Mines* (formerly Hillside Group, with some later locations). The claims are on Martinez Creek, 4½ miles by road southeast of El Dorado and south of the Union Mine. The workings are in Mariposa slate east of the 'bull quartz' vein. Holdings cover 4500 ft. in length on the strike.

Little work has been done on the claims since 1926. During that year, a few men were working through a short adit, winze and drifts reaching a depth of 86 ft. below the outcrop on Hillside No. 3 claim. The slate there dips west and ore is found in small stringers, seams and floors which lie nearly flat, with a slight dip west. Ore was hoisted by hand in a small bucket and taken about one-half mile by sled to a small 5-stamp mill beside the creek. The scanty water supply in summer permits of milling only a few tons of ore at a time. The returns from the small tonnages milled from 1923 to 1926 inclusive varied widely, as might be expected, ranging from less than $4 to over $80 a ton.

In 1926 an adit was run 900 ft. into the lower part of the hill and this adit would have to be extended 300 ft. further to be directly under the workings first described. This would give 230 ft. greater

depth than that in 1926. There is a compressor and other equipment at this adit.

At a distance of 700 ft. south of the recent work, an old adit 600 ft. long crosscuts the vein. Between the two, another crosscut 70 ft. long reveals low-grade quartz and is thought to be on the Red Top spur vein. The 'bull quartz' vein of the Mother Lode traverses the Martinez claim, 300 ft. west of the Hillside No. 3 workings. Still farther west, on the Climax claim, are early-day Mexican workings.

*Miller (Ribbon Rock) Claim* adjoins the Superior Claim on the north. Hayward and Lane prospected the two claims in 1900. The shaft reached an inclined depth of 400 ft. (320 feet vertical). As this work was done at a time when the State published few records, nothing definite is known of the results. The vein in the shaft is said to be 2 to 4 ft. wide. There is no record of production.

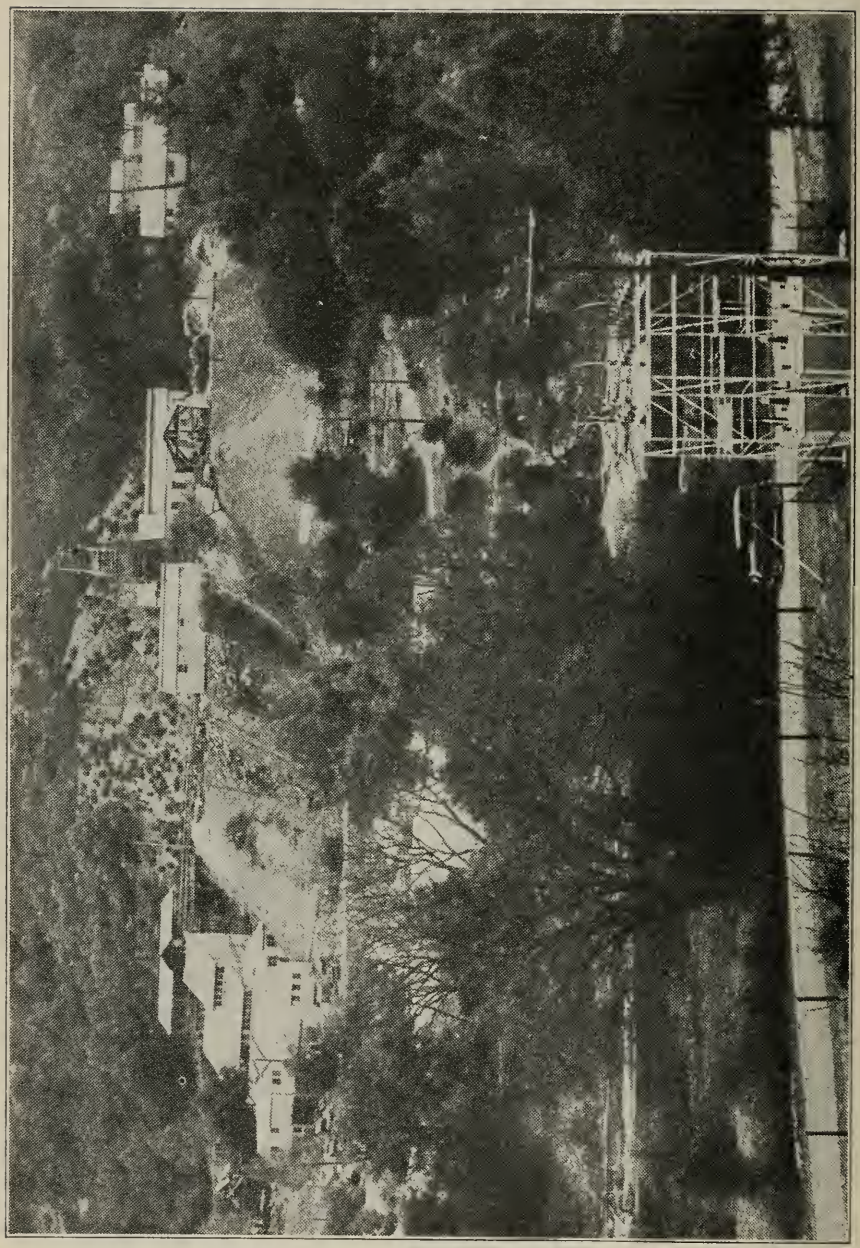
*Montezuma Mine* near Nashville had supplied ore for many arrastres in the early days of California mining, but the principal shaft was flooded from 1871 to 1899. The ore that came from the property during that period was from numerous other shallow workings which prospected the vein for a length of 1200 ft. Production was about $2,000 in 1890 and a 5-stamp mill was operated irregularly during the next ten years.

In 1899 the old shaft was unwatered and the mine was active until 1907, with 10 stamps in irregular operation. From 1901 to 1907, not including 1905 and 1906, the Montezuma produced $41,071 and the recovery varied from $1.70 to $12 a ton. In 1905 and 1906, Gross and Kleeburg of New York had this mine and the adjoining Havilah under option. They crosscut 47 ft. on the 1200-ft. level of the Havilah and drifted north a reported length of 1285 ft. It is claimed that ore was found, but details are lacking.

Meanwhile, a new shaft had been sunk 360 ft. on the Montezuma 300 ft. south of the old 360-ft. shaft. In the old shaft, ore had been stoped to a depth of 120 ft. and a maximum length of 250 ft. In the new one the principal stope was 100 ft. long and extended from No. 3 level upward for about 175 ft. just south of the shaft. The vein here was reported 8 ft. to 20 ft. wide; but the dimensions given must be in error as the tonnage indicated would be greatly in excess of actual production.

In 1914, California Exploration Company leased the mine and sank the new shaft from 360 to 1000 ft. inclined depth (899 ft. vertical), starting in the hanging-wall slate. Three new levels were turned, called 500-, 800-, and 1000-ft. levels. No. 5 or 800-ft. level, which showed the most promise, was drifted 315 ft. north and 100 ft. south and east, with assays indicating possibilities on the north side for about 150 ft. in length. The 500-ft. level explored a total length of 250 ft., partly in each direction, and the 1000-ft. level was run south 200 ft. The war is said to have caused cessation of work.

In 1927 and 1928 a production of a few hundred tons of $10 ore was reported from the Montezuma. In 1931 W. Price and associates formed the Nashville Mines, Ltd., and reopened the shaft and levels down to and including the 1000-ft. level. A 10-stamp mill was started February 3, 1932, and during part of that year crushed 35 tons of ore daily. On the 800-ft. level a length of 180 ft. was opened.



Montezuma-Apex Mine, Nashville.

*Courtesy of The Mountain Democrat, Placerville.*

A raise was made from 1000-ft. to 800-ft. level and a drift started about midway between was called the 900-ft. level. On the 1000-ft. level, ore was found in a spur vein after running a new crosscut 125 ft. south of the old one. Where this spur entered the main fissure good ore was found and had been followed 40 ft. on the spur vein at time of visit in 1932. Later this spur was found to give about 100 ft. of stoping length on the 900-ft. level. Ore was reported 12 ft. wide on the 900-ft. level and 8 ft. wide on the 1000-ft. level. The main Mother Lode fissure, however, did not show much pay in this section. This company crushed over 3000 tons of ore which yielded about $8 a ton, with tailing carrying $1 to $2 a ton.

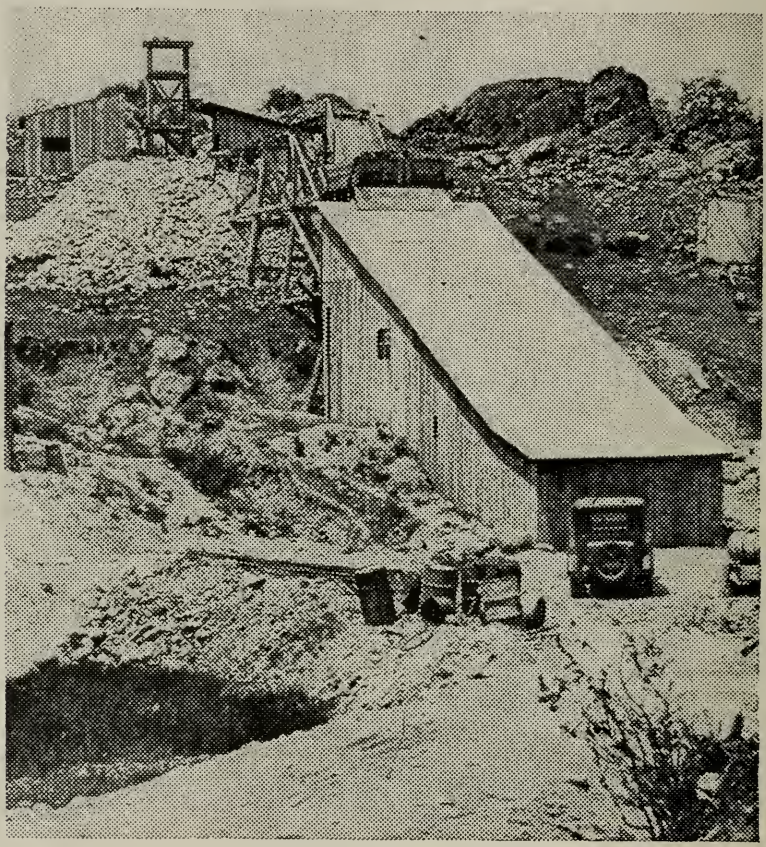
In January, 1933, they were succeeded by Montezuma-Apex Mining Company, a subsidiary of Utah-Apex Mining Company. The latter has greatly expanded the scale of operations, erected and put in commission a new mill (see flow sheet under Metallurgy), and has operated steadily since with results which they state are satisfactory. From 60 to 100 men have been employed and in June, 1934, about 2½ tons of ore per man-shift was being produced.

The vein dips on an average of 60° E. with Mariposa slate walls in most places, though in some parts the hanging wall is a gray schist or 'mashed sandstone,' and small strips of greenstone are interbedded with the slate. The shaft has been extended to 1300 ft. inclined depth, and 1100-ft., 1200-ft. and 1300-ft. levels opened. The shaft dips about 66° E. and at 1300 ft. is 148 ft. from the vein in the footwall. The Havilah and Montezuma shafts are about 1000 ft. apart, and both mines are being worked; the 1200-ft. level was being driven south toward a point under the Havilah shaft. The 1200-ft. level of the Havilah, driven years ago under the Montezuma (see ante) corresponds to 1050 ft. inclined depth in the Montezuma. Besides the work on the spur vein which was stoped 100 ft. long between 900- and 1000-ft. levels and less than that below, a new ore shoot has been found and is being worked in the main vein. On the 1200-ft. level, this showed 570 ft. in length, most of it ore, in June. For 250 ft. this is reported to be 6 ft. wide, and the balance 4 ft. wide besides a heavy gouge, varying from 2 to 5 ft. thick on the footwall. The gouge is said to carry about 0.1 oz. of gold along the ore body. This ore body extends from 100 ft. north of shaft to over 400 ft. south of it. On the 900-ft. level, two faults moved the ore westward going south; one strikes N. 60° E. and the other east, but ore is found south of them. An anticline was also noted which arched up the spur vein between 1000 and 1050 ft. depths, as if the hanging wall had moved upward.

A system of modified shrinkage stoping is used where the gouge is not too heavy. In starting stopes timbers are put three sets high (two above the drift). Grizzlies with 10-inch spaces are installed every three sets (18 ft. center to center) on top of the second set with bulldozing chambers, protected by heavy timbering on top of third set, and chutes 18 ft. apart. Above in the stopes stulls are used as required. With wide gouge or faulted ground square sets are used.

On the surface, a 12 by 16 in. Knight crusher and Gyrex screen reduce ore to 1½ inches for the Marcy mills. The hoist is driven by 125-h.p. motor. Two compressors are operated by 150-h.p. and 75-h.p. motors. About 240 tons of ore was being milled daily in June, 1934.

Very creditable costs were reported from this mine for early 1934. The total for extraction, exploration, hoisting, tramming, milling, and amortization, including indirect costs, was given as less than $4 a ton. With increased tonnage, using both Marcy mills full time, it was believed this could be lowered. Poles for timbering are bought locally, costing about one cent per linear foot per inch of diameter, but it was stated that sawed Douglas fir could be brought from Coos Bay at less than local dealers quoted.



Ophir mine and mill, two miles south of El Dorado.

*Courtesy of The Sacramento Bee*

*Ophir Mine* is two miles south of El Dorado in the footwall of the Mother Lode. The workings are in and near the brecciated zone at the contact of diabase and its various phases with quartz porphyrite. A vein from a few inches to 14 inches wide had been followed 98 ft. west on a very flat dip. Near the face the dip steepened and a winze was being sunk here. In this winze, high-grade ore occurs in narrow stringers where a dike showing flow structure and containing iron sulphide and arsenopyrite occupies the contact of basic porphyry on east and agglomerate on the west. This agglomerate forms the ridge running north on the west of the workings. It contains corroded

fragments of the basic porphyry, others of a more nearly granitic phase, and some of the dike rock, all cemented by a greenish gray breccia.

About 100 ft. east of the adit portal a shaft had been sunk 36 ft. on a quartz seam that had widened to 18 inches with a reported value of $7.50 a ton.

A 2-stamp mill was put on this property early in 1933.

*Oro Fino Mine* is a mile south of Garden Valley in a narrow strip of amphibolite schist. The vein where seen was 4 ft. wide, strikes northwest to north and had been opened to a depth of 80 ft. with a dip of 50° when visited. Ore was hauled to the Frog Pond mill in 1926 and the small tonnage crushed gave good returns. In 1930 a few tons of high grade was reported.

*Orum Mining and Development Company's* property was idle when last visited, and the shaft was full of water to the collar. There was a mill of 5 stamps, one concentrator, two gasoline engines, an old compressor and a jackhead pump. It is on Martinez Creek near the Union Mine.

*Pacific Quartz Mine* at Placerville is one of a large group of mining claims owned by Placerville Gold Mining Company, extending for three miles along the Mother Lode, from a mile south of American River to Weber Creek; numerous placer claims are also owned, holdings comprising 1400 acres in all. Many of the claims were early-day producers of which only a fragmentary history remains.

Pacific mine was found in 1852 and had a 2-stamp mill in 1854. From then until 1861 the production was $480,000 the mill having been increased to 4, 10 and finally 20 stamps. The production up to 1883 was about $1,000,000, and some production was made up to 1889 when $6,000 output was recorded. It then lay idle 20 years; reopening started in 1910 but was suspended. In 1914 a 5-stamp mill was built and small tonnages of ore that yielded about $5 a ton were crushed then and in 1915. This was partly from the dump and partly from the talc orebody.

The principal productive vein was the Pacific on the west side of the lode. The Pacific shaft was sunk 700 ft. vertically and ore was stoped from the 500-ft. level to the surface. This vein was thought to have been lost by being faulted eastward between the 300- and 400-ft. levels. Later work in that direction failed to reveal any ore. As described in 1888, this ore-shoot was 150 ft. long and the average width of vein was 12 ft. Professor Thomas Price stated the ore milled from $6 to $18 a ton with a tailing loss up to 75 cents a ton. The concentrate made up one-half of 1% of ore and consisted of "arsenical pyrites or iron, containing 3% nickel and assaying $85 per ton in gold and $2 per ton in silver," according to him.

The shaft is in the black slate of the footwall at the 700-ft. level, where a crosscut east 85 ft. cut a talcose orebody 75 ft. long by 7 ft. wide. The black slate hanging-wall was encountered 130 ft. farther east in the crosscut. From the 700-ft. level 200 ft. north of the shaft a winze was sunk at an angle of 70° for an inclined depth of 1365 ft. This winze entered the footwall slate at 1600 ft. in depth and continued in it to the bottom.

The vein here was in an ankerite zone and was ribbon rock in places colored by mariposite. This zone was 300 ft. wide at the 700-ft. level and 125 ft. wide on the 2000-ft. level where cut in drill-holes. Extensive diamond drilling was done from the 1700-ft. and 2000-ft. levels, but over 8000 ft. of holes drilled are said to have failed to show ore.

There is a 5-stamp mill and other equipment at the Pacific shaft in Placerville.

*Pocahontas Mine,* three miles south of El Dorado was opened in 1854 and in 1867 had a 10-stamp mill. The mine was then yielding ore averaging $15 a ton from a vein 4 ft. wide, and had repaid all expenses of opening and equipment. Work continued intermittently until 1896. Two veins occur, the Pocahontas being 4 to 9 ft. wide and the Empire, 300 ft. distant and 20 inches wide. Both dip east, the Empire being the steeper; the strike is curving, about northwest. The mine workings are in a feldspathic porphyry variously classified as diorite-porphyrite or quartz porphyrite. This rock is a phase of the large body of granitic rocks of varying composition lying to the north and northwest, around which the Mariposa slates take a curving course northeast and north. The body of rock enclosing the veins on this property has intruded the Calaveras rocks and the diabase on the foot-wall of the Mother Lode. On the surface, the contact of the Mariposa slate is about a mile east. The claims cover 3000 ft. on the strike.

The mine was worked through two shafts, the Burlingham incline 400 ft. long (205 ft. vertical depth) and the Burke 45° incline 300 ft. deep, south of it. They are 157 ft. apart on the surface but diverge in depth. The Pocahontas vein was drifted north 500 ft. and south 200 ft. on the 100-ft. level and a total of about 1000 ft. on the 300-ft. level of the Burlingham shaft. The ore was stoped out to a depth of 400 ft. on dip and for a length of 300 ft., being 10 ft. wide between 300-ft. and 400-ft. levels. From the 400-ft. level about 150 ft. south of shaft a winze was sunk 125 ft. which is said to have struck a gouge 5 ft. wide carrying pieces of ore, and this may indicate a dip slip or a contact; the walls changed to slate near the bottom of winze; this is probably Calaveras slate.

The ore varied in value from $4 to $25 a ton. The amount of water was moderate in the mine.

*Poverty Point (Guildford) Mine,* two miles north of Placerville, covers nearly a mile along the course of the Mariposa slate. Claims in this group are Iowa, Hidden Treasure, Bantam, Baltic, Humming Bird, Poverty Point, Brighton, Bell and Fortuna. The ground is on the south side of the the river canyon and the topography made possible development through adits, of which four have been run. These have permitted low operating cost. It is claimed locally that the mine has produced about $500,000. There is a record of a little over $200,000 output since 1901, of which nearly all was produced between 1912 and 1917.

Two ore-shoots formerly mined were stated to be 420 ft. and 200 ft. long. The former was mined for a width of from 3 ft. to 20 ft. Recently a body of low-grade 'schist ore' from 2 ft to 10 ft. wide has been stoped for about 200 ft. in length. Ore shoots occur in a zone of schist and slate 30 ft. wide with a footwall of altered amphibolite

schist or similar greenstone, which intrudes the slates in a long narrow dike. So-called east and west veins have been distinguished about 30 ft. apart. The hanging-wall or east vein had the larger shoot. Ore is composed of 'stringer leads' in the slate or schist. The average width is said to have been 5 ft. During the principal recent period of operation, under Guildford Gold Mining Company, the ore averaged during favorable years from $4 to $5 a ton. The concentrate, chiefly pyrite, ranged from 3% to 3½% of ore in such years, and carried about six-tenths of the gold and silver; this concentrate varied from $40 to $88 a ton in yield.

The Guildford Gold Mining Company quit work in 1917, after running the River adit level (150 ft. above American River) 600 ft. In 1919 the mill containing 15 stamps burned, and the property was idle except for a short time in 1920, until 1923 when El Dorado County Mining and Development Company began work, and advanced the River adit level 685 ft. They installed ten 1000-lb. stamps but milled only a little ore in 1925. Some time later the Golden Horseshoe Mining Corporation took the property and have been working it in a small way since. They have sunk a winze below the old 500-ft. level adit which was 127 ft. deep in February 1932. They made a small production in 1931.

*River Hill Group* covering 178 acres of mining claims and mineral rights 1½ miles north of Placerville, includes the Gentle Annie mine, which was a producer previous to 1899. Its shaft had then reached a depth of 600 ft. and there were 4000 ft. of drifts. This mine had a 10-stamp mill. After the death of Melton, the owner, the property was enlarged by adding adjoining ground and the River Hill shaft was sunk and connected at 400 ft. with the old Gentle Annie workings from which ore was taken in 1901 to supply the new 20-stamp mill. In the next three years this new shaft reached a depth of 1050 ft. and finally was sunk to 1550 ft. A drainage adit 2400 ft. long also connected with the 735-ft. level. There are five veins on the property, including the so-called dolomitic vein, similar to the second one mentioned under Pacific Mine. The shaft was between two of these veins, which were opened by crosscuts from the 300-, 400-, 500- and 700-ft. levels. The River Hill was an important producer from 1901 to 1906 inclusive, yielding from $2.50 to $4.80 a ton.

The hanging and footwall veins were separated by a horse of slate 5 ft. thick, according to W. E. Christian. With a width of 30 to 40 ft. between walls, ore was sometimes 20 ft. wide. Below the 1000-ft. level, a fault crossed the veins from the footwall to the hanging wall and is said to have cut off ore. Ore-shoots were 200, 150 and 80 ft. long, according to Christian.

*Robert Veerkamp prospect* is in NW¼ of Sec. 33, T. 12 N., R. 10 E., six miles north of Kelsey by road. It is on and near the contact of Mariposa slate and a long, narrow diabase dike which runs northwest along the west side of the Mother Lode, about one mile west of the main lode. The land has been farmed for many years and only shallow prospecting has been done.

Two veins occur here—one a heavy barren or low-grade, white quartz vein striking N. 25° W., which is faulted to the west, looking north, by a smaller vein of bluish quartz carrying sulphide, and strik-

ing N. 15° E. The latter vein is claimed to assay well in places. The reddish soil on the summit of the hill, and in the obtuse angle between the veins carries gold and some shallow drill holes are reported to have indicated possibilities of a considerable tonnage of ore. The material is so much decomposed and the work is so shallow that it can not be determined whether this gold comes from weathering of one or both quartz veins, from ore at the intersection of the veins, or is from the upper, oxidized part of a disseminated sulphide orebody or stringer lead in the diabase; the latter appears probable.

The land had been taken under option in March, 1932, and some work was planned.

*Sherman Mine* is a mile north of Placerville, south of Big Canyon Creek. The principal period of production began in 1908 (though there had been some output in 1905) and continued through 1911. The total production during that period was about $136,000. The yield per ton varied from $3.15 to $6.50 and average width of vein was reported to be 5 ft., with two ore shoots 60 ft. long, between walls of Mariposa slate.

A shaft was sunk at an angle of 74° (the dip of vein) to a depth of 750 ft. and at a point 1250 ft. north of shaft on the 750-ft. level a winze was sunk on the vein 350 feet deep. Most of the drifts were run north, the total length drifted on vein varying from 250 ft. on 100-ft. level to 1400 ft. on 400-ft. level. Most of the gold and silver were obtained from the concentrate, which was principally pyrite and formed 3½% to over 4% of ore. It was worth from $66 to $91 a ton.

The plant comprised a double-drum hoist, large compressor and ten 1000-lb. stamps with 2 crushers and 5 concentrators.

*Sliger Mine* was found in 1864, and was known as a producer of specimen gold ore, though the gold was more evenly distributed than in many nearby mines. By 1874, an adit had been run 375 ft., cutting the vein at a depth of 200 ft., and a shaft was sunk to connect with it. The ore then was said to come on the footwall side of the quartz vein, in north-raking shoots. The ore was crushed in a small mill and the production was estimated at $125,000 to a depth of 170 feet. Later operators sank to 300 ft. and are supposed to have produced $100,000 more but made no accounting.

Little was done thereafter until 1922, when Sliger Gold Mining Company was organized, and the shaft was sunk to a depth of 500 ft. on the dip of vein. Milling began in January, 1929, and good ore was produced during the two following years. In the attempt to make the mine pay its way, the shaft was not properly protected and caved in early in 1931.

The country rocks are amphibolite, slate and serpentine, the latter forming a narrow dike. The mine is at the contact with black slate on the footwall and ankerite and serpentine on the hanging wall. A strip of slate was probably caught up in the intrusive from which the amphibolite was derived.

On the 350-ft. level, the crosscut was driven in a curved course for 33 ft. through ankerite or similar mixed carbonates, stained by mariposite, and likewise on the 500-ft. level. At the time of visit, a raise had been put up in ore between these two levels, and ore had

been stoped for a length of 60 ft. and a maximum width of 19 ft. and a height of 30 ft. above the 500-ft. level.

The principal orebody seen is on the footwall side and is a replacement of an igneous member of the amphibolite schist series, probably a dike. It is now highly silicified, with some carbonates, and is thickly impregnated with fine crystals of sulphides disseminated through the rock. The ore has no definite wall but merges into low-grade rock. There are two classes of ore in this part of the mine—so-called black slate or schist ore and grey-schist ore. On the 350-ft. level, a drift had been run 260 ft. north and was claimed to be in ore for 110 ft.; on the 500-ft. level, the drift was 220 ft. long on the north side of shaft at time of visit, of which 120 was claimed to be ore, which varies in width from 14 inches to 19 ft. wide. This ore is hard and requires little timber. Most of the pay is in the sulphides which make up 3.7% of ore, and contain from $75 to $375 a ton, nearly all gold. The concentrate consists almost entirely of pyrite. The smelter assay of one lot of concentrate was:

| | |
|---|---|
| Au | 10.71 ounces |
| Ag | 0.6 ounce |
| Sb | 0.7% |
| Insoluble | 23.2% |
| Iron | 31.0% |
| Sulphur | 32.5% |
| As | 0.6% (in some lots) |

Freight and smelter charges were $22 a ton. The operating cost was low at that time. Ore was being milled with 15 stamps of a total of 25. A 40-mesh screen was used, and a discharge only 2½ inches high. Recovery was said to be about 80%. Ore value ranged from $5 to $15 a ton. Seven men employed were producing and milling 18 tons of ore in two shifts.

In October, 1931, C. L. Wright of New Jersey and associates took a lease on the mine and reclaimed the shaft. A 100-ton ball-mill and flotation plant were installed late in 1932. Early in 1933, Middle Fork Gold Mining Company was formed to continue work which has been carried on continuously since. The underground workings have not been visited by the writer since 1930. In 1932, a winze was sunk 100 ft. from the 500-ft. level and a drift 200 ft. long on the 600-ft. level was reported by Charles Mayotte, then superintendent, to be all in ore, which crosscuts showed to be 32 ft. wide. He believed over 100,000 tons of good ore was reasonably assured, of an average grade of about $10 a ton.

In that year, work was started on the surface outcrop of the vein near the south boundary of the Sliger claim. Shortly after, suit was started by Paul Ricci, the owner of the adjoining *South Sliger* claim. This was terminated in 1934 by the purchase or lease of the latter claim in July, 1934, by Middle Fork Mining Company.

Stamps have been displaced in the present mill, which uses a ball-mill, flotation and gravity concentration. Two-stage crushing with Blake and Symonds crushers is used ahead of the ball-mill, which works in closed circuit with two Dorr rake classifiers. From the mill, pulp passes over a Deister Overstrom concentrator which saves perhaps 75% to 80% of the gold in a high-grade concentrate. The table tailing is sent to a conditioner, then to six Kraut rougher cells and

two cleaner cells. Concentrate is hauled by truck to Selby smelter. Mill capacity is about 70 tons a day. A high recovery is being made.

In 1934, a crew of 40 men in mine and mill was producing about 50 tons a day. This property should be a profitable producer for several years.

*St. Lawrence Mine.* The following claims are included in this group: North St. Lawrence, St. Lawrence, St. Lawrence No. 2, Guadalupe and the St. Louis, which is adjacent to the St. Lawrence on the east, and the St. Lawrence mill site. The property is about eight miles north of Placerville on a good road at an elevation of about 2000 ft.

The original location was made in June, 1867, by placer miners who had followed the rough coarse gold upstream on Irish Creek and Dutch Creek until they found the vein. The locators worked the mine until March, 1871, when it was bought by Bateman and Company, who put up a 20-stamp mill and continued the sinking of the shaft and the opening of levels at intervals of 100 ft. The mine at the time of this sale had reached a depth of about 600 ft. on the dip of the vein.

In a contemporary description of the property it was stated that the quartz in the St. Lawrence occurs in lenticular forms not continuing for any great distance but invariably found to come in again in similar veins lying along the main fissure. At a depth of 550 ft. in the main shaft the quartz is said to have entirely given out and gouge took its place, following the well-marked footwall. At the 500-ft. level, 160 ft. north of the shaft, the quartz gave out and there was in its place a 5-ft. gouge showing slickensides on both walls. Before giving out in this direction, the quartz jumped several times from the hanging wall to the footwall and vice versa. The underground aspect appears to have been similar to that of other mines in the Mariposa slate as the apparent hanging wall is said to be repeated two or three times in parallel slickensides.

In sinking the shaft from the 500-ft. level to the 780-ft. or eighth level the work was in this broken-up ground.

The English company failed to supply money to carry on prospecting work when the grade of rock taken out of the lower levels became too low to pay expenses. The mine was attached by creditors in September, 1874, and was sold to persons who started mining in May, 1876, and after reaching the ninth level sank a winze 200 ft. deeper in the search for the continuation of the upper orebody. In the eighth level north of the shaft they found the apex of a rich lens of ore which proved to be very small. The deeper work from the ninth level down resulted in the discovery of no new ore worth mentioning.

The record of the value of ore and the total production of the mine is not complete. The original discoverers took out ore worth $10 a ton. The English company could not work at a profit ore that went less than $8.54 per ton, as is shown by a letter written by their superintendent in 1874 when he advised against running the mill on ore of that grade. For the year 1873 this company's reports showed 8062 tons milled; bullion produced, $141,002.13; average per ton, $17.49. The small lens of ore below the eighth level is claimed to have paid $27 per ton and to have yielded about $18,000. In a statement by Lieutenant George M. Wheeler in 1878, he says the St. Lawrence up to that time had produced $465,000 and had cost $300,000. The mine has been

idle since. This vein was explored for a total length of about 200 ft. north of the discovery shaft and 194 ft. south and so far as known practically no crosscutting was done after the pay-shoot disappeared. The recoveries noted above were of free gold only.

*Sunrise Mine,* one mile northeast of Kelsey, near the Dalmatia and supposed to be on the same vein, was another low-grade deposit that made a record for low operating cost. Although equipped with a 10-stamp mill in the 1890's, it was worked only in a small way and irregularly. Though several crushings of ore were made, and an operating cost of 63 cents a ton was claimed, there is no record of the amount of gold produced.

*Superior (Tin Cup) Mine,* one mile east of Diamond Springs and adjoining the Larkin on the north, was located in 1867 as the Reid mine. It is described in detail in Report VIII of the State Mineralogist. At that time it had been explored to a vertical depth of 160 ft. by a steeply inclined shaft 180 ft. long, and two adits, one 250 ft. long and one 700 ft. long. It had a 10-stamp mill. The yield of ore varied from $5.80 to $15 a ton, and concentrate worth $130 a ton made up 5% of ore. The tonnage of ore was, however, small and the mine was closed soon after. It remained idle until prospecting work was started in 1900 by Hayward and Lane upon it and the adjoining Miller claim on the north. Hayward purchased the Superior claim, but nothing is known of his short-lived operations beyond the fact that prospecting finally reached an inclined depth of 400 ft.

*Taylor (Idlewild) Mine* on the westerly section of the lode three miles southeast of Greenwood was found in 1865. At the surface the vein was two feet wide, but increased with depth and an average width of 14 ft. was stoped during the best days of the mine. The footwall is hard greenstone which runs through the property in the form of a narrow dike. Mariposa slate forms the hanging wall. A well-defined gouge occurred on the hanging wall, and considerable trouble was caused by swelling ground. Stopes were filled with mine waste and with surface rock dropped through a chute. The shaft for the first 300 feet was sunk in the vein then passed into greenstone.

The mine was reopened in 1888 after lying idle; in that year it had a 10-stamp mill and produced $4,000. In 1890, 10 more stamps were added, and the 500-ft. level was opened and was producing 20 tons of ore a day, which averaged $6 a ton. The orebody was reported 30 feet thick on that level, consisting of "quartz, lime, feldspar, slate, etc." Within two years the mine became the principal producer of the county. The levels, 100 ft. apart, explored and developed an ore-shoot 400 ft. long. Below the 500-ft. level, according to E. J. Kendall, superintendent of the mine for 13 years, the orebody decreased in size with no quartz below the ninth level. Crosscuts were run about 100 ft. on the 10th and 11th levels without results, and drifts were run southeast 600 to 700 feet (probably to the property line) on the 200- and 300-ft. levels. The shaft was sunk to 1225 ft. on an incline of about 50° before work ceased.

Apparently there is no complete record of the mine's output, the owner claiming tonnage records were lost by fire in 1906. Beginning in 1893 and continuing several years, the annual output was from

$146,000 to $150,000. The mill capacity in 1893 was 110 tons a day with 40 stamps. Estimating an average monthly run of 3000 tons would indicate an average recovery of about $4.16 a ton. This, however, is at wide variance with the statement of E. J. Kendall who said ore averaged $8.40 to $8.55 a ton. It is known the best ore was on the hanging wall. The gold was finely divided as a rule, but at times in sheets. Ore is described as typical 'ribbon rock.' Sulphides which were of good grade in the earlier operations became too poor to ship and concentrate was later cyanided at the mine. The mill capacity was increased again in 1896, and the value of heads dropped because of increasing tonnage handled. There is no record of output after 1900. The total production has been estimated at about $1,000,000. The amount of dividends, if any, is unknown. But with production averaging about two tons per man-shift for all employees, and with cheap water power and timber, there should have been a fair return, for a few years at least.

*Union (Springfield) Mine.* Although this mine is credited with being the largest gold quartz producer in the county, there has been little definite information available concerning it. Most of the work was done upon it many years ago by operators who refused to divulge results of their operations, and part of this activity was during a period when the State was not publishing reports on mines. In the period since 1916, the property has been idle and has belonged to nonresident owners who have kept the records outside the State and have failed to supply information requested. It is believed that the production has been overestimated, as is common in such cases.

The surface of the present holdings (see claim map) supported a large mining population in the early 1850's, and the float ore was worked in arrastres after the stream placers were exhausted. Professor Silliman induced his relatives and friends to finance quartz mining and the Union and Church (later worked as separate mines) were consolidated. A pay shoot north of the Union shaft is said to have yielded $450,000 from 15,000 tons of ore mined before 1868. The Cosumnes vein croppings and shallow workings on it west of the Union to a depth of 120 ft. are said to have produced $150,000 more. In spite of the good grade of ore found, the project failed and the mine lay idle several years until Alvinza Hayward and Hobart purchased it. They changed the name to Springfield and operated about 15 years. They had a mill of fifteen 600-lb. stamps with a capacity of only 26 tons a day. Concentrate worth $150 a ton was saved on Frue vanners and treated by chlorination. In 1886, near the latter end of these operations, it was stated[1] that the ore-shoot (probably meaning series of shoots) was 800 ft. long and the vein averaged three ft. in width. The Springfield shaft was finally sunk to a depth of 1640 ft. (vertical), and the Clement shaft 900 ft. deep on an incline of 70°. Over 21,000 ft. of drifts and crosscuts are reported to have been run.

After an idleness of about 10 years, Union Gold Mining Company began work and a 30-stamp mill was built. In 1897, a production of $36,000 was reported. From then until 1909, only estimates of production were made public. These indicate that from 20,000 to 40,000 tons of ore was crushed annually, yielding from $5 to $7 a ton. In 1909, the last year for which a figure is at hand, 12,000 tons yielded

[1] Sixth Report of the State Mineralogist, pt. 2, p. 43, 1886.

a little over $5 a ton. During this period, the same company operated the Schoolgirl workings, west of the Union, and separate figures for the two are not available. The latter had a 20-stamp mill.

The Union was again reopened in 1914-1916 and some prospecting was done, but the results of this were disappointing.

Five veins striking about N. 16° E. occur in the Mariposa clay slates on this property. They dip 60° to 79° E. and are reported to be 5 ft. to 10 ft. in average width. The main or Springfield shaft is 320 ft. east of the hanging-wall vein at the surface, crossing the vein at the 1200-ft. level. The west gouge vein was also crossed by this shaft about 60 ft. above the 1600-ft. level. Four ore-shoots, varying from 100 to 250 ft. long, are said to have been worked out from the 1300-ft. level to the surface. The work done up to the time Hayward and Hobart quit had been done almost entirely on the southernmost 1000 ft. of the property. When they drifted farther north, it is said the vein broke into stringers. Under Harpending (1896-1909) a crosscut was run east to search for the vein which had either been faulted or had turned east. They struck a vein 1400 ft. north of the north end of the Springfield old workings and 700 ft. south of the Church line. Ore was opened here 230 ft. long in a winze and it was from here that much of the later production came.

Late in 1934, Gold Fields American Development Company began unwatering the Springfield workings for the purpose of further prospecting under ground. About 30 men have been employed. An electric power line was built and pumps were started at the end of July. J. T. Boyd is manager.

*War Eagle Claim* is the south extension of the Big Chunk. It has been a pocket producer only. There is an old shaft believed to be 80 feet deep with which an adit 150 feet long connects. This adit shows a vein about 18 inches wide.

#### Seam Mines

Along the Mother Lode in El Dorado County beginning at Placerville and extending into Placer County, a peculiar kind of gold quartz deposit has been extensively worked by the hydraulic process. They have been known from the earliest days of mining in that region as 'seam mines' or 'seam diggings.' These deposits occur in both the Mariposa clay slate and in the amphibolite schist. They consist of broad and rather well-defined lodes in which the gold occurs generally in narrow veinlets of quartz and at times in the gangue rock itself. In these lode zones, which are sometimes nearly 100 feet wide, there may be several systems of quartz veinlets, each system having a definite strike and dip within the main lode. Generally these stringer systems are bounded by the main lode walls which are often quite definite. At times in such a lode the quartz stringers may increase in size to solid lenses several feet wide. In such cases it may be difficult to say whether a mine should be called a 'seam mine' or a quartz mine. The pay in the seams occurs as a rule at the intersections of two such stringer systems or perhaps where the stringers of such a system intersect one of the larger lenses of quartz. At Georgia Slide, for example, there are three systems of seams. One system strikes northeast and dips 45° northwest; another stands nearly vertical with a northwest strike and the third which follows the strike of the schistosity of the schist and

slate a little north of northwest, dips 75° east. The principal pay in this property was found at the junctions of the first and third seam systems and on the side of the quartz away from the so-called sand streaks.

The peculiar circumstances found by the early miners who first investigated these deposits led them at once to experimentation with the only methods of mining they were acquainted with at the time. They found that these seam zones were decomposed to such an extent that a large part of the gold in the upper portions of the deposits could be saved by the ordinary sluicing and hydraulicking methods, as there was available at the time considerable water for mining. This method of operation came into quite extensive use through that entire section even during the decade between 1850 and 1860 and continued up to the time of the prohibition of hydraulic mining. There are few definite records of actual results of these operations but such figures as are available are extremely interesting. The following are some of the results as reported in 1874 by Amos Bowman:

The *Grit* mine at Spanish Dry Diggings from 1860 to 1867 produced $100,000 but a great deal more had been taken out as early as 1852 and it was estimated that the mine had produced in all $300,000. The *Beatty* mine at that time had been worked for 17 years and was producing at the rate of $1,000 a month clear of all expenses to the owner of a one-eighth interest. The *French* claim of Greenwood had produced about $100,000.

Some of these properties, as nearly as can be figured, produced over a dollar a cubic yard and were worked at a cost only a little higher than the ordinary hydraulic mine. As work progressed, however, in these mines it was found the method of operation had a strictly limited application at depths varying from a few feet to 60 feet. The seam zones began to show the fresh rock not decomposed by the agencies which had softened the upper part and this hard rock could no longer be worked by the hydraulic method. Due also to the slabby and angular character of the material, these mines had to be equipped with sluices having a much higher grade than the ordinary placer mining sluices so that in mining for any length of over a few hundred feet along one of these seam zones the miner would eventually find the upper end of his sluices coming up to the surface and work would have to be stopped on account of lack of grade.

The most important group of 'seam mines' is that at Georgia Slide, an old mining camp 2 miles north of Georgetown. In its course northwestward through El Dorado County the main belt of the Mariposa slate is separated into two branches by a large lens of amphibolite schist and the Georgia Slide mines are in this schist and on the eastern branch of the slate where Canyon Creek has cut a deep trench across the gold-bearing formations exposing them in cross section in such a way as to facilitate cheap hydraulic mining. The mines here will be described under the heading of Georgia Slide mines.

The following is a list of the principal 'seam mines' that have been worked in the regions mentioned:

*Blasdel* seam mine is on Dark Canyon north of Georgetown. This seam belt runs about 2000 ft. in a northerly direction but has not been extensively worked.

*Carrol* claim is on the east slope of Greenwood Hill. The pit here was 80 feet long by 40 ft. wide and 15 ft. deep, but the production is unknown. There are three systems of quartz seams of which one in particular has produced gold.

*Castile* mine between Empire and Manhattan canyons, near Garden Valley. This contains two quartz veins separated by 3½ ft. of slate lying in a seam zone which has been hydraulicked for a length of 100 ft. by 70 ft. wide and 18 ft. deep.

The *Cedarberg* mine, about a mile south of the Sliger on the east side of American Canyon had an interesting history. Cedarberg and his partners had prospected without success until they had exhausted their funds. They then applied to the water company for one day's free supply of water which was given them, but their flume was in such poor condition that it broke when the water was turned into it and the water in running to waste down the hillside uncovered a quartz vein three inches wide with some parallel veinlets. The partners mined out here 90 cubic yards which yielded $45,000 to a depth of 25 ft. As work went deeper on the vein it increased in size to a width of 2 ft. at a depth of 200 ft. An ore shoot 50 to 80 ft. long was worked and the mine was famous for a time as a producer of beautiful gold specimens, the free gold occurring in white quartz and the sulphides in a bluish quartz. Some attempts have been made in later years to bring this property into operation as a quartz mine but these have not met with success.

West of Cedarberg is a seam belt which is cut through by the American Canyon and which contains the *George, Smith, American, Conner,* and *Mauley* seam mines concerning which there is nothing of particular interest available.

The *Cranes Gulch* or *Whitesides* mine had produced $100,000 from a pit 150 ft. wide by 250 ft. long by 70 ft. deep before 1874. This would indicate an average yield of over one dollar per cubic yard.

*French* or *Nagler* claim, which adjoins the town of Greenwood, has an old hydraulic pit of probably two acres in area which has been worked out to a depth of nearly 100 ft. The seam belt here was about 200 ft. wide with porphyry on the west and decomposed slate on the east. From the figures quoted by Bowman it would appear that the production of gold from the hydraulic mining operations here previous to 1874 had amounted to about $100,000 or an average of about $3 a cubic yard but this figure seems excessive. The largest amount of pay is supposed to have come from the intersection of a cross vein with the main vein. A shaft was sunk at this intersection in early days and the ore taken out is said to have milled extremely well. This vein shows mineralized schist with two feet of solid quartz. The record of the water company which sold water to this mine showed that from the total production mentioned over $20,000 had been paid for water or an average of $80 a week.

The *Fisk* or *Porphyry* ledge is one-fourth mile north of Placerville and has produced large sums. In 1870 Fisk took $3,000 out of a space 8 ft. by 10 ft. by 20 ft. and the claim produced considerable ore carrying $100 to the pan with pieces weighing as much as 25 to 40 ounces each.

*Georgia Slide Mines.* In this group are the *Blue Rock* claim containing 27 acres, the *Pacific* claim of six acres, the *Beatty* claim of 26 acres and the *Parsons* claim of 20 acres. The Beatty claim was operated continuously from 1853 and the Pacific and Blue Rock from 1856 until 1895 when the operators were notified to discontinue mining by the hydraulic process. The geology of these claims has already been mentioned. In later years when the rock began to be a little firmer than in the early workings powder was used in large quantities to break down the bank previous to washing with the hydraulic giants. Quartz specimens containing gold were sorted out by hand as far as was possible and were crushed in a hand mortar. It has been stated that these properties produced from $2 to $3 a ton in gold which was worth $18.50 an ounce. After 40 years of operation the bank on these properties was 150 ft. deep and an immense amount of tailings had accumulated in Canyon Creek. The various operators had a working agreement by which the grade was lowered at the different properties in such a way as to permit all of them to continue work.

The deposit at Georgia Slide is essentially a large lenticular body some three-fourths of a mile long and nearly 400 ft. wide at the widest point. No close estimate can be made of the total amount of gold which has come from this deposit. Oregon Canyon, which is claimed to have produced $2,000,000 in a length of three-fourths mile, and the lower course of Canyon Creek, which produced $1,500,000, derived their gold from this seam belt. Several millions more were produced by the seam mines mentioned above and there are still remaining a million tons left unworked in the deposits above the level of Canyon Creek. In recent years the deposit has been extensively sampled with the idea of making a large low-grade quartz mine. These plans, however, were never carried out. Several small stamp mills were operated on seam mines here after the prohibition of hydraulic mining. These handled selected ore in a small amount.

*Grit* mine at Spanish Dry Diggings was first worked by Spaniards, who carried the dirt down the steep canyon to American River to wash it. It was most productive in 1852. Between 1860–1867, it produced $100,000 and in 1865 a mass of beautifully crystallized gold which weighed 101.4 ounces Troy, and came from a shaft sunk a few feet below the bottom of the hydraulic pit, which was 50 ft. by 150 ft. by 60 ft. deep. No particular vein was noted until a depth of 40 ft. was reached, where lenses of quartz were found with a maximum width of 3 ft. over a length of 30 ft. These were followed 100 ft. deeper, and the mine then lay idle many years after a reputed production of $300,000.

In 1919, two men struck rich specimen ore in the vein at the bottom of the old workings and a stock company was formed with the idea of developing milling ore. Although several thousand dollars was produced in crystallized gold, the venture was not a success. The gold occurs in quartz and calcite, with amphibolite schist and slate walls 3 ft. apart, and the lens of ore was 30 ft. long, with the richest values at one end. Both walls here carry considerable pyrite in coarse crystals.

The *Sliger* mine in Sec. 25, T. 13 N., R. 9 E., and the *Hines* mine half a mile north of it were both worked in the early days as seam mines and then lay idle for a long time until a few years ago when work was

resumed and both of them have shown promise of developing into good quartz mines. They are mentioned elsewhere in this report.

The *Hart* mine near and north of the Castile has a seam zone which has been hydraulicked for a length of 175 ft., a width of 50 ft. and a depth of 40 ft. After the fresh rock had been reached in this pit considerable prospecting was done to see if the ore was rich enough to be handled in a quartz mill. An adit was run for a length of 320 ft. which encountered four separate stringer systems or veins all parallel in line within the seam zone. On the first of these veins a drift was run 175 ft. south and on the fourth a drift 70 ft. long was driven. This property has lately been taken under option by J. A. Flink and others. Underground these veins appear as stringer leads in the amphibolite schist. An 8-stamp mill was put on this property in 1930 and a mill test of 11 tons was made from the first vein. Although it was reported that this gave satisfactory results there has been nothing further done with the property until 1933, when work was resumed and is being continued.

The *Hodge* and *Lemon* mine is a north extension of the Fisk and is on the north end of Quartz Hill. The seam zone here has been mined for a length of half a mile on these adjoining claims and for several hundred yards there is an old open cut which was 30 to 40 ft. deep, with underground workings of unknown extent below the pit. The cross veinlets in this mine dipped 40° north and rich pay was found where these veinlets strike the east wall zone. This zone continues on through Poverty Hill.

The *Spanish* mine on the hill west of Greenwood has a seam belt 100 ft. wide. An area 400 ft. long by 24 ft. wide when hydraulicked went 800 ounces gold worth $17 an ounce or a total value of $13,600. Much work has been done on this property in later years in the endeavor to develop it into a quartz mine but so far this work has not been successful. The pay was followed 80 ft. below the bottom of the pit and the vein was drifted on 20 or 30 ft. in each direction.

The *St. Lawrence* seam mine produced $23,000 in 10 months with a crew of four men using 100 miner's inches of water which cost for the above period $8,000.

In the *Spanish Dry Diggings district* there are three seam belts, the one farthest west having been worked at the *Waun* mine, the one at Spanish Dry Diggings containing the *Grit* and the *Barr* and *Crosston* and the third, a quarter of a mile east of the Grit, called the Fargo belt.

The *Waun* mine is a half mile west of Spanish Dry Diggings. Four series of seams have been worked, first by the hydraulic method and two of these were followed into the hill by tunneling. This seam belt is 50 ft. wide. The gold occurred in quartz veinlets running parallel to the strike of the seam zone and also intersecting veinlets crossing the seam belt.

The *French Hill* mine near Spanish Dry Diggings is on this seam belt, one-half mile south of the Waun mine.

The *Swift* and *Bennett* claim at the southern edge of Georgetown paid a good profit in the 1870's; some of the rock yielded a dollar to the pan.

MINES AND PROSPECTS ON MOTHER LODE BELT IN EL DORADO COUNTY

| Name of mine | Location | | | To whom assessed | Elevation, feet | Area, acres | Bibliography |
|---|---|---|---|---|---|---|---|
| | Sec. | Twp. | Range | | | | |
| Adams Gulch Group | 24, 25 | 9 N. | 10 E. | Estate of J. C. Heald, Nashville | 1,200 | 320 | XII, p. 101; XIII, p. 132; XV, p. 279. |
| Adjuster | 12 | 9 N. | 10 E. | O. A. Ingraham, El Dorado | 1,300 | 30 | XV, p. 280. |
| Alpine | 15, 16 | 12 N. | 10 E. | Lucero Gold Mining Co., Inc., 530 Wilcox Bldg., Los Angeles; lessee, Pacific Mg. Co. | 2,550 | 180 | VIII, pp. 167-168; XIII, p. 132; XV, p. 280. |
| American Seam | | | | | | | |
| Argonaut | 17 | 12 N. | 10 E. | Gold Unit Mining Co., c/o Ralph E. Fry, R.F.D. 2, box 1736, Sacramento | 1,900 | 25 | VIII, p. 176; X, p. 176; XII, pp. 101-102; XIII, pp. 132-133; XV, p. 280; Pre. Rep. 8, p. 29; XVIII, p. 209. |
| Bathurst | | | | | | | See Coe Hill. |
| Beattie and Parsons | 34<br>3 | 13 N.<br>12 N. | 10 E.<br>10 E. | Ida Barklage Ackley, Georgetown; Flora Barklage, Hotel Sacramento, Sacramento; Emma B. Schutz, Arbuckle; Beattie Bros., Georgetown | 2,450 | 60 | XI, p. 203; XII, p. 102; XIII, p. 133 ;XV, p. 281 (see Georgia Slide also.) |
| Blasdel Seam | | | | | | | |
| Big Chunk | 24 | 11 N. | 10 E. | Margaret E. Smith, Placerville, et al | 2,200 | 13 | XV, p. 281. |
| Big Four | 34 | 12 N. | 10 E. | John Hurley, Kelsey; James O'Brien, Kelsey; Mary E. Rhodes, Placerville | 1,850 | 20 | XV, p. 281. |
| Big Sandy | 24 | 11 N. | 10 E. | Big Sandy Mining Co., c/o J. T. Kelly, Kelsey | 2,000 | 99 | X, p. 173; XII, p. 104; XIII, p. 134; XV, p. 281. |
| Black Hawk | 24 | 11 N. | 10 E. | Oscar Reeg, Placerville, and Estate of Blair, Placerville | 2,000 | 20 | XV, p. 281. |
| Blue Lead | 3 | 11 N. | 10 E. | Mrs. M. P. Bennett, Placerville | | | |
| Blue Rock | 34 | 13 N. | 10 E. | James E. Flynn, Georgetown; Geo. C. Rau, 1017 G Street, Sacramento, et al | 2,450 | 25 | XI, p. 203; XII, p. 104; XV, p. 282. |
| Bonanza | 11 | 8 N. | 10 E. | C. E. Padilla | | | XVIII, p. 44. |
| California Jack | 22 | 12 N. | 10 E. | Mrs. E. M. Potts and A. L. Jeffrey, 527 Citizens National Bank Bldg., Los Angeles | 2,315 | 40 | XIII, p. 136; XV, p. 282. |
| Carrol Seam | | | | | | | |
| Castile Seam | | | | | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Cedarburg | 1 | 12 N. | 9 E. | J. T. Smith, Greenwood | 2,300 | 20 | XII, p. 106; XIII, p. 137; XV, p. 282; ; M. R. West of the Rocky Mts., 1873, p. 47. |
| Chaparral | 26 | 11 N. | 10 E. | Phillip Stingle, Boston and Margaret Kelly, Kelsey | 2,000 | 20 | XV, p. 283. |
| Cherokee Flat | 24 | 13 N. | 9 E. | Charles Davis and J. Federwitz, Greenwood | | 17 | |
| Church | 12 | 9 N. | 10 E. | Seymour Hill, El Dorado | 1,180 | 42 | VIII, pp. 191-193; X, p. 171; XII, p. 106; XIII, pp. 137-138; XV, p. 283; XVIII, p. 209; Bull. 18, p. 92. |
| Cincinnati | 3 | 11 N. | 10 E. | W. J. and J. T. Davey, Garden Valley, et al | 1,750 | | XII, p. 106; XIII, p. 138. |
| Coe Hill | 33 | 12 N. | 10 E. | Ed. Bathurst, Folsom | | | |
| Conner Seam | | | | | | | |
| Cranes Gulch | 15 | 12 N. | 10 E. | Charles Jerrett, Georgetown, et al | | 80 | |
| Crown Point Consolidated | 31 | 10 N. | 11 E. | Estate of James Richards, Placerville | 1,800 | 20 | XII, p. 107; XIII, p. 138; XV, p. 283; XX, p. 8. |
| Dalmatia | 13 | 11 N. | 10 E. | William A. Bell, c/o W. F. I. Bell, Kelsey | 2,000 | 102 | VIII, p. 177; X, p. 174; XI, pp. 201-202; XII, p. 108; XV, p. 284. |
| Epley and Mammoth | 20 | 10 N. | 11 E. | Placerville Gold Mining Co., Placerville | | 26 | VIII, pp. 186-187; X, p. 173; XIII, p. 109 (See also Pacific). |
| Esperanza | 28 | 12 N. | 10 E. | Garden Valley Mining Co., c/o Haswell Bros., St. Johns Chambers, Chester, England | 2,460 | 20 | X, p. 175; XII, p. 109; XIII, p. 140; XV, p. 285. |
| Esperanza | 7 | 12 N. | 10 E. | Paul Ricci, Greenwood, et al | 1,950 | 20 | Field Report. |
| Eureka | 6 | 10 N. | 11 E. | Placerville Gold Mining Co., Placerville | 2,750 | 10 | X, p. 178; XI, p. 203; XII, p. 109; XV, p. 285 (See also Pacific). |
| | 36 | 11 N. | 10 E. | | | | |
| Falls | 1 | 9 N. | 10 E. | Joseph Drechsler, Diamond Springs | 1,250 | 16 | XV, p. 285. |
| Fisk | 7 | 10 N. | 11 E. | J. H. Skinner, Placerville | 1,900 | 17 | XIII, p. 140; XV, pp. 285-286. |
| French | 13 | 12 N. | 9 E. | California Water and Mining Company | 1,700 | 18 | XI, p. 204; XII ,p. 110; XIII, p. 141; XV, p. 286. |
| French Hill | 36 | 13 N. | 9 E. | A. J. Johnson and E. S. Hadley, Sacramento | 2,000 | 160 | XII, p. 110; XIII, p. 141; XV, 286. |
| Frog Pond and Marigold Cons. | 28 | 12 N. | 10 E. | S. W. Collins and C. K. Norris, Garden Valley | 2,200 | 40 | XV, p. 286. |
| Garden Valley | 28 | 12 N. | 10 E. | | | | (See Esperanza.) |
| George Seam | | | | | | | |
| Georgia Slide (incl. Pacific, Beatty, Parsons and Blue Rock) | 3 | 12 N. | 10 E. | Ida Barklage Ackley, Georgetown; Flora Barklage, Hotel Sacramento, Sacramento; Emma B. Schutz, Arbuckle; James E. Flynn, Georgetown; Beattie Bros., Georgetown; Geo. C. Rau, 1017 G St., Sacramento | 2,450 | 86 | XV, pp. 281, 282, 292; XX, p. 8. |
| | 34 | 13 N. | 10 E. | | | | |
| German | 14 | 9 N. | 10 E. | Seymour Hill, El Dorado | 1,150 | 100 | XIII, p. 142; XV, p. 286; Bull. 19, p. 90. |
| Golden Gate | 14, 23 | 9 N. | 10 E. | Estate of James Richards, Placerville | 1,100 | 80 | X, p. 171; XII, p. 117; XIII, p. 150; XV, p. 286. |

MINES AND PROSPECTS ON MOTHER LODE BELT IN EL DORADO COUNTY—Continued

| Name of mine | Location | | | To whom assessed | Elevation, feet | Area, acres | Bibliography |
|---|---|---|---|---|---|---|---|
| | Sec. | Twp. | Range | | | | |
| Golden State | 29, 32 | 13 N. | 10 E. | Ida Barklage Ackley; Georgetown; Emma B. Schutz, Arbuckle; Flora Barklage, Hotel Sacramento; Sacramento; John Federwitz, Auburn | 2,600 | 20 | XI, p. 204; XII, pp. 111-112; XIII, p. 143; XV, p. 287 (see also Georgia Slide). |
| Gold Mountain and Monitor | 11 | 8 N. | 10 E. | Mrs. B. E. Carter, 811 E. St., Sacramento and Mrs. L. S. Santbin, Nashville | 800 | 40 | XV, p. 286. |
| Gopher-Boulder | 11, 14 | 11 N. | 10 E. | Gopher-Boulder Mining Co., c/o W. F. I. Bell, Kelsey | 1,950 | 42 | VIII, pp. 175-177; XIII, p. 143; XV, p. 287; Bull. 18, p 98. |
| Grey Eagle | | | | | | | (See Big Sandy.) |
| Griffith Cons. | 30, 31 | 10 N. | 11 E. | Estate of James Richards, Placerville | | 82 | VIII, p. 189; X, p. 172; XII, p. 112; XIII, p. 144; XV, p. 287; Bull. 18, p. 92. |
| Grit Cons. | 30 | 13 N. | 10 E. | Harriet A. Baughman, 1430 P St., Sacramento | 1,000-2,000 | 24 | XVII, p. 426; XVIII, p. 44; XX, p. 8; Pre. Rep. 8, p. 29. |
| Gross No. 1 | | | | | | | (See Harmon Group.) |
| Guildford | | | | | | | (See Poverty Point.) |
| Harmon Group | 6<br>36 | 10 N.<br>11 N. | 11 E.<br>10 E. | Placerville Gold Mining Co., Placerville | | | VIII. p. 181; X, pp. 173, 178: XI, p. 203; XII, p. 109, 113; XIII, p. 161; XV, p. 285. |
| Hart Seam | | | | Lessees, J. A. Flink et al. | | | |
| Havilah | 2 | 8 N. | 10 E. | Joshua Hendy Iron Works, 75 Fremont St., San Francisco; lessee, Montezuma-Apex Mg. Co. | 900 | 60 | XII, p. 119; XIII, p. 151; XV, p. 299; XVIII, pp. 45, 209; Pre. Rep. 8, p. 30; Bull. 18, p. 91. |
| Hines-Gilbert | 24 | 13 N. | 9 E. | Hines-Gilbert Gold Mines Co.; lessee, Gold Fields American Dev. Co. | 900-1,900 | 32 | XVII, p. 427; XVIII, p. 209; XX, pp. 178-179. |
| Hodge and Lemon Seam | | | | | | | |
| Idaho | 14, 23 | 9 N. | 10 E. | Sidney Pringle, c/o E. C. Pringle, 354 Russ Bldg., San Francisco | 1,250 | 20 | XV, p. 288. |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Ida Livingston | 12, 13 | 11 N. | 10 E. | Ida Livingston Mining Co., c/o A. W. Craig, 1317 Oak St., San Francisco | 2,000 | 20 | XV, p. 288. |
| Independence | 10 | 9 N. | 10 E. | Independence Quartz Mining Co., c/o Howard Mountain, 57 E. Twenty-first St., New York | 3,000 | 20 | XIII, p. 145; XV, p. 288. |
| Isabell | 3 | 11 N. | 10 E. | Mrs. M. P. Bennett, Placerville | 2,000 | 40 | XV, pp. 288-289. |
| Ivanhoe, Willimantic and Barney | 28<br>15, 22 | 12 N.<br>12 N. | 10 E.<br>10 E. | Fred Schmeder, Georgetown | 2,300 | 20 | XV, pp. 175, 176; XII, pp. 114, 126; XV, p. 289. |
| Kelly | 13 | 11 N. | 10 E. | Miss Margaret Kelly, Kelsey | | | Agricultural Patent. |
| Kelsey | 24, 25 | 11 N. | 10 E. | Lessee, Kelsey Mining Co., 519 California St., San Francisco | 1,800 | 32 | XV, p. 289. |
| Lady Emma (Currie) | 13 | 11 N. | 10 E. | The Karolyi Mining Co., c/o H. Summerfield, 830 Market St., San Francisco | 2,000 | 7 | XIII, pp. 147-148; XV, p. 289. |
| La Moile, Ophir | 11 | 9 N. | 10 E. | Walter I. Bidstrup, El Dorado | | 24 | XII, p. 115; XIII, p. 148. |
| Larkin | 29, 30 | 10 N. | 11 E. | Larkin Mining Co., San Francisco | 2,000 | 28 | XIII, p. 148; XV, p. 289; Bull. 18, p. 93. |
| Lincoln | 34 | 13 N. | 10 E. | P. F. and Jas. L. Morgan, Georgetown | 2,350 | 20 | XIII. pp. 148-149; XV, p. 289. |
| Lone Jack | 28 | 12 N. | 10 E. | Campbell and Metson, San Francisco | 2,000 | 20 | X, p. 176; XII, p. 116; XIII, p. 149. |
| Lone Star | 31 | 10 N. | 11 E. | D. H. Jackson, Box 112, La Jolla, California | | | XII, p. 116; XIII, p. 149; XV, p. 290. |
| Lookout | 11 | 9 N. | 10 E. | Seymour Hill, El Dorado | 1,600 | 20 | XII, p. 116; XV, p. 290; XVIII, p. 45. |
| Loveless | 11, 14 | 9 N. | 10 E. | L. T. Loveless and Brothers, El Dorado | 1,700 | 14 | XV, p. 290. |
| Lucky Jack | 11 | 9 N. | 10 E. | Thomas Murphy, Logtown | 1,800 | 18 | XV, p. 290. |
| Lucky Marion | 12 | 12 N. | 9 E. | Lucky Marion Mining Co., 619 St. Charles, St. Louis | 1,830 | 20 | XIII, p. 150; XV, p. 290. |
| Mameluke | 3 | 12 N. | 10 E. | P. F. and James L. Morgan, Georgetown | 2,700 | 130 | XI, p. 204; XV, p. 290. |
| Manhattan Cons. | 36 | 9 N. | 10 E. | Nellie A. White, Box 695, Coalinga, et al. | 1,600 | 77 | XV, p. 291. |
| Manzanneta | 24 | 11 N. | 10 E. | Mrs. G. C. Baum | 1,500<br>1,800 | 17 | Field report. |
| Martinez | 12, 13 | 9 N. | 10 E. | Martinez Gold Mining Co., W. G. Busick, Pres., El Dorado | | 132 | XV, p. 288. |
| Mauley Seam | | | | | | | |
| Mathenas Creek (Schneider & Co.) | 31 | 10 N. | 11 E. | Mathenas Quartz Mines and South Co. | 1,800 | 20 | VIII, p. 190; X, p. 172; XII, p. 117; XIII, p. 150; XV, p. 291. |
| McDowell and Wiltshire | 36 | 9 N. | 10 E. | W. B. Hammell, El Dorado, et al. | | 20 | |
| Miller | 30, 31 | 13 N. | 10 E. | C. O. Miller, 2214 M St., Sacramento | | 19 | |
| Miller | 20 | 10 N. | 11 E. | Mary E. Goyan, Placerville | 1,800 | 20 | VIII, p. 189; X, p. 172; XII, p. 122; XIII, p. 150; XV, p. 291. |
| Montezuma | 2<br>35 | 8 N.<br>9 N. | 10 E.<br>10 E. | Estate of J. C. Heald, Nashville; lessee, Montezuma-Apex Mg. Co. | 900 | 20 | XII, p. 118; XIII, p. 151; XV, p. 291; Bull. 18, p. 91. |
| Morning Star, Lucky Girl, Evening Star, Lucky Boy | 2 | 12 N. | 10 E. | E. F. Porter, Georgetown | | 80 | |
| Mountain Boy, Mountain Girl, Mountain Slide, Eastern Star | 33 | 12 N. | 10 E. | Jessie L. Whittle, 1716 Webster St., Oakland | | 20 | |

MINES AND PROSPECTS ON MOTHER LODE BELT IN EL DORADO COUNTY—Continued

| Name of mine | Location | | | To whom assessed | Elevation, feet | Area, acres | Bibliography |
|---|---|---|---|---|---|---|---|
| | Sec. | Twp. | Range | | | | |
| Mulvey Point and Pacific | 34, 35 | 13 N. | 10 E. | Ida Barklage Ackley, Georgetown; Flora Barklage, Hotel Sacramento, Sacramento; Emma B. Schutz, Arbuckle; Catherine Reinhard, Georgetown; Mrs. A. B. Wiesen, 720 Seventeenth St., Sacramento | 2,500 | 40 | XV, p. 292 (see also Georgia Slide). |
| Nagler Seam | | | | | | | (See French.) |
| Nashville | | | | | | | (See Havilah.) |
| New El Dorado | 36 | 13 N. | 9 E. | New El Dorado Mining Co., c/o E. Jennings, Box 1547, Route 4, Napa | 2,300 | 20 | XII, p. 119; XIII, p. 152. |
| | 1 | 12 N. | 9 E. | | | | |
| New Garibaldi (Oakland) | 12 | 12 N. | 9 E. | J. B. Hayes, San Francisco | 1,975 | 20 | XIII, p. 152; XV, p. 293 (see Golden Gate). |
| Ohio and Eagle (Sacramento) | 7 | 12 N. | 10 E. | Thomas Holder, Greenwood | 1,950 | 18 | XII, p. 119; XIII, pp. 152, 157; XV, p. 293. |
| Old Harmon | | | | | | | (See Harmon Group.) |
| Old Judge | 12 | 11 N. | 10 E. | Old Judge Mining Co., c/o Mary A. Murphy, 57 Post St., San Francisco | | 40 | |
| Olive | 18 | 12 N. | 10 E. | Sarah J. Dorn, 812 Phelan Bldg., San Francisco | | 40 | |
| | 7 | 12 N. | | | | | |
| Ophir | | | | | | | |
| Oriflamme (Oro Flem) | 31 | 10 N. | 11 E. | Estate of S. H. Maginess, c/o Mill B. Maginess, 1607 Ninth Ave., San Francisco | 1,250 | 20 | VIII, pp. 189-190; X, p. 172; XV, p. 293. |
| Oro Fino | 33 | 12 N. | 10 E. | | | | |
| Orum | 12 | 9 N. | 10 E. | Orum Mining and Development Co., O. A. Ingraham, Placerville | 1,250 | 45 | XV, p. 300. |
| Pacific | 17, 18 | 12 N. | 10 E. | Placerville Gold Mining Co., Placerville | 1,950 | 1,400 | VIII, pp. 183-186; X, p. 173; XI. p. 203; XII, p. 120; XIII, p. 163; XV, pp. 293-295; XVIII, p. 209 (includes Epley, Pacific, Mammoth, Albright Henrietta, Faraday, Maryland, Old Harmon, Young Harmon, Gross Nos. 1 and 2 et al.). |
| Pacific Seam Mine | | | | | | | (See Georgia Slide Mines.) |
| Parsons Seam | | | | | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Pocahontas | 10, 11<br>14, 15 | 9 N.<br>9 N. | 10 E.<br>10 E. | Eunice M. Chase, 26 O'Farrell St., San Francisco | | | XII, p. 121; XIII, p. 154; XV, p. 295; Bull. 18, p. 95. |
| Porphyry | | | | | | | (See Fisk.) |
| Poverty Point | 36 | 11 N. | 10 E. | Guildford Gold Mining Co., Placerville | 2,000 | 500 | XV, pp. 287-288. |
| Rainbow | 21 | 12 N. | 10 E. | J. Ramsdell and C. M. Root, Garden Valley | 2,200 | 20 | XIII, p. 155; XV, p. 295. |
| Reed and Keyser | 17 | 10 N. | 11 E. | John F. Limpinsel Estate, Placerville | | | |
| Richelieu | 1, 12 | 9 N. | 10 E. | Richelieu Mining Co., 354 Pine St., San Francisco | | 20 | |
| River Hill | 6<br>36 | 10 N.<br>11 N. | 11 E.<br>10 E. | G. M. Clark, Placerville, and Guilford Gold Mining Co., Placerville | 2,000 | 178 | X, p. 177; XII, p. 111; XIII, pp. 141-143; XV, p. 296; Bull. 18, p. 94. |
| Rising Sun | 11, 14 | 11 N. | 10 E. | A. F. and J. C. Pedrine, c/o J. C. O'Donnell, Placerville, and A. F. Forni, Placerville | 1,850 | 20 | XV, p. 296. |
| Rose | 18 | 10 N. | 11 E. | Placerville Gold Mining Co., Placerville | | | VIII, pp. 182-183; XII, p. 122; XIII, p. 155 (see Pacific). |
| Rosecranz | 21 | 12 N. | 10 E. | Geo. Steppe, Placerville, Chas. R. Young, Bijou; Lillie and Wm. Crook, c/o Arthur S. Morey, 660 Eleventh Ave., San Francisco; Sallie Mitchell, Placerville; A. Siesnop, Garden Valley and Josephine F. Simpers, 1559 Sacramento St., San Francisco | 2,100 | 20 | VIII, p. 171; X, p. 176; XII, p. 122; XIII, p. 155; XV, p. 296. |
| Rixford | | | | | | | (See Welch.) |
| Ryan | 24 | 11 N. | 10 E. | M. B. Ryan, Placerville and Barrett Bros., Shingle Springs | 2,000 | 20 | XV, p. 296. |
| Sam Martin | 6, 7 | 12 N. | 10 E. | Ella S. Graves, c/o W. L. Thompson, East Liverpool, Ohio | | | |
| School Girl | 12 | 9 N. | 10 E. | Oakland Bank of Savings, c/o Charles Hussey, 507 Empire St., Box 1724, Spokane, Wash. | | 32 | (Part of Union.) |
| Selby | 29 | 10 N. | 11 E. | Warren Larkin, Placerville | 1,900 | 60 | XV, p. 296; Bull. 18, p. 93. |
| Sherman | 8 | 10 N. | 11 E. | Sherman Mine and Milling Co., Placerville | 2,000 | 80 | XV, pp. 297-298. |
| Sleeping Beauty | 12 | 8 N. | 10 E. | Martha S. Kercheval, R.F.D., box 27, Courtland; C. M. Chubb, Vacaville | | 10 | |
| Sliger | 25 | 13 N. | 9 E. | Sliger Gold Mining Co., c/o W. H. Simpers, 3628 Fulton St., San Francisco; lessee, Middle Fork Gold Mining Co. | 2,000 | 47 | XII, p. 123; XIII, p. 157; XV, p. 297; XIX, p. 143; M. M. West of Rocky Mtns., 1873. p. 47. |
| Smith Seam | | | | | | | |
| Spanish Seam | 12 | 12 N. | 9 E. | Mrs. L. E. Pease, 2131 M St., Sacramento | | | |
| Spanish Hill | 17 | 10 N. | 11 E. | Pioneer Hardware Store, Placerville | 2,100 | 50 | XII, p. 123; XIII, p. 157; Field Report, 1919. |
| Santa Claus | 7 | 12 N. | 10 E. | Santa Claus Mining Co., c/o Emma P. Polcaro, 1503 Allesandro St., Los Angeles | | 20 | |

MINES AND PROSPECTS ON MOTHER LODE BELT IN EL DORADO COUNTY—Continued

| Name of mine | Location | | | To whom assessed | Elevation, feet | Area, acres | Bibliography |
|---|---|---|---|---|---|---|---|
| | Sec. | Twp. | Range | | | | |
| Starlight | 10 | 9 N. | 10 E. | Starlight Mining Co., 206 Sansome St., San Francisco | 1,750 | 20 | XIII, p. 123; XIII, p. 157; XV, p. 298. |
| St. Clair | 14 | 11 N. | 10 E. | John Peters and Thomas Gregory, Kelsey | 2,100 | 20 | XV, p. 298. |
| St. Lawrence | 2, 11 | 11 N. | 10 E. | A. Mierson and Sons, Placerville; Pioneer Hardware Store, Placerville | 2,200 | ------- | XI, p. 202; XII, p. 173; XIII, p. 156; XV, p. 298. |
| St. Lawrence Seam | ------- | ------- | ------- | ------- | ------- | ------- | |
| Sun Rise | 13 | 11 N. | 10 E. | Phillip L. Barrette, Shingle Springs | 2,350 | 10 | XIII, pp. 158-159; XV, p. 299. |
| Superior | 30 | 10 N. | 11 E. | Emma Rose, c/o Garret W. McEnerny, 2002 Hobart Bldg., San Francisco | 1,800 | 20 | VIII, pp. 187-189; X, p. 172; XII, p. 124; XIII, p. 159; XV, p. 299. |
| Swift and Bennett Seam | 11 | 12 N. | 10 E. | ------- | ------- | ------- | |
| Taylor | 21 | 12 N. | 10 E. | W. E. Deane, San Francisco | 2,000 | 18 | VIII, pp. 168-171; X, p. 176; XI, p. 205; XII, p. 113, XIII, p. 145; XV, p. 299; XVIII, pp. 209, 210. |
| True Cons. | 6, 7 | 10 N. | 11 E. | Placerville Gold Mining Co., Placerville | 2,310 | ------- | VIII, pp. 180-181; XII, p. 125; XIII, pp. 144, 159 (see Pacific Mine also). |
| Tullis | 1 | 9 N. | 10 E. | Tullis Mining Co., San Leandro | 1,700 | 20 | XIII, pp. 159-160; XV, p. 299. |
| Uncle Sam | 3 | 12 N. | 10 E. | Adolph and C. Beattie, Georgetown | | | |
| | 35 | 13 N | 10 E. | El Dorado Mining Co., c/o Chas. Hussey, 507 Empire State Bldg., Spokane, Wash.; lessee, Gold Fields American Dev. Co. | ------- | 19 | XIII, p. 160. |
| Union | 11, 12 | 9 N. | 10 E. | | | | |
| | 13, 14 | 9 N. | 10 E. | | 1,310 | 219 | VI, p. 43; VIII, p. 167; XV, p. 299; XVIII, pp. 209-210; Bull. 18, p. 92. |
| Up-to-date | 36 | 13 N. | 9 E. | Paul Ricci, Greenwood | ------- | 40 | |
| Vandergrift | 26 | 9 N. | 10 E. | J. P. Vandergrift, Placerville | 1,650 | 40 | XV, p. 300. |
| Van Hooker | ------- | ------- | ------- | ------- | ------- | ------- | (See Harmon Group.) |
| Van | 2 | 12 N. | 10 E. | W. L. Dickerson, San Francisco | 2,700 | 20 | XI, p. 203; XII, p. 126; XIII, p. 161; XV, p. 300. |
| Waun Seam | 24 | 13 N. | 9 E. | ------- | ------- | ------- | |
| Whitesides | ------- | ------- | ------- | ------- | ------- | ------- | (See Cranes Gulch.) |
| Young Harmon | ------- | ------- | ------- | ------- | ------- | ------- | (See Harmon Group.) |

## AMADOR COUNTY

### Geology

Most important of the Mother Lode counties from the standpoint of gold production and mine development, Amador County has also had the highest percentage of successful lode mining operations of any region in the State. With a length of 20 miles traversed by the Mother Lode formations, the section between Jackson and Plymouth, ten miles long, has been most intensively developed and has yielded most of the gold produced in the county.

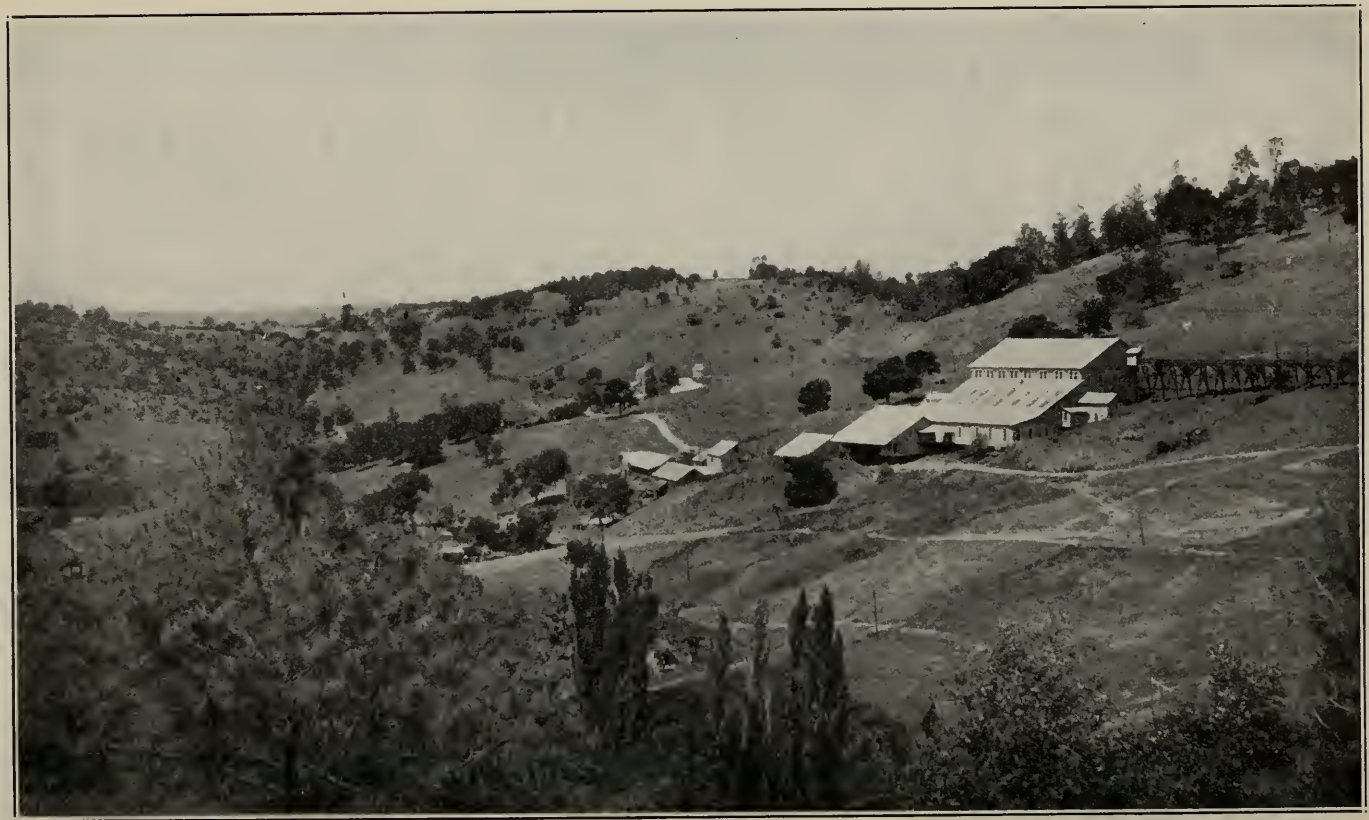
It is believed that the geologic notes herein under the individual mine descriptions are sufficient to emphasize the most important points, which are only briefly alluded to in these introductory paragraphs.

By far the greater part of the production has been from mine workings in the Mariposa (Jurassic) clay-slate, in the vicinity of contemporaneous, interbedded greenstones now having the aspect of dikes due to the tilting of the entire series, but originally deposited as mud flows of volcanic ash and breccia and other extrusive rocks, formerly called augite porphyrite, later known as meta-andesite. As a matter of fact, the alteration of such originally igneous members found in the mine workings has often advanced so far that even the expert petrographer can not positively name the original rock.

Veins in the slate are typically fissure fillings of white quartz, often ribboned with thin slate layers. The gold in such ore is mostly free; the percentage of sulphides is uniformly small, 1% to 2%; and the amount of gold associated with the sulphides so closely that it is recovered only after smelting or cyanidation, is not generally over 20% of the total. There has been little variation in the character of these ores in the range of about 6000 ft. on the dip so far explored. The ribbon ore of course indicates repeated reopening of the fissure along the walls of the veins, with additions of vein matter.

At depths varying from a few hundred to several thousand feet, the veins pass on the dip from the Mariposa clay-slates into the altered igneous rocks (meta-andesite, amphibolite schist, or as commonly called, greenstone). When this happens, the vein commonly flattens in dip, takes on a more massive character, and becomes itself of lower grade, often too lean to make ore; but lenses of a different variety of ore are usually found in the nearby greenstone walls, close to the vein. These are the 'gray ore bodies' or 'schist ore.' They consist of hydrothermally altered greenstone, or amphibolite schist, containing 2% to 4% of disseminated auriferous sulphide, mostly pyrite. This ore is largely ankerite, but with considerable silica and some albite. Often such ore in the schist is traversed by a network of quartz stringers and is called a 'stringer lead.' From 50% upward of the gold in it is associated with the sulphides. Commonly, though not always, it is of lower average grade than the slate quartz ore.

These gold deposits have been classified as mesothermal, therefore as having been deposited at moderate depths. How much deeper they must be proven to extend before they may be considered deep-seated



A view of the Mother Lode in Amador County showing, in foreground, the Bunker Hill Mine; in center, the Treasure Mine, and in background, left, the headframe of the Fremont Mine.

*Photo by C. A. Logan.*

is an interesting question. Of the 'true fissure' type, they have been distinguished from the younger, bonanza type of gold deposit by the persistence of the ore in depth and by the repeated occurrence of ore, usually in lenticular form, particularly on the dip. As a corollary of this, so-called barren zones may be expected sooner or later, through which sinking may have to be carried several hundred feet in low-grade material before another orebody is found.

The ore-shoots are generally so much longer on the dip than on the strike that the old empiric rule regarding these relations cannot be applied. Many of the better ore-shoots can be quite definitely correlated with the junction of a spur vein or link or cross vein with the main fissure.

In Amador County especially, experience has shown that ore is not necessarily confined to any particular channel in the slate, but may occur in either the footwall or hanging-wall sections or in the middle of the slate, if bodies of interbedded greenstone of sufficient size are there and if other conditions are right. The whole width of the slate, under these favorable conditions, must be crosscut from massive footwall greenstone to hanging-wall greenstone before the possibilities of finding ore can be safely considered as exhausted. Massive contact quartz veins however are seldom themselves important ore producers.

The general location of the lode was determined by the course of an ancient, pre-mineral major fault zone along which compressive strains (caused by the growth of the Sierra Nevada with the intrusion of its granitic batholith) found relief in rupture with reverse faulting. This fault zone, following here a belt of weak rock (Mariposa slate) and weak contacts (slate-greenstone) was a locus of movement over a long period, favoring the formation of ore by the building up of ribbon veins by additions of vein matter on the side next the wall. After the period of compressive stresses there must have occurred subsidence on the hanging-wall side sufficient to open tension fissures, which in many cases helped form orebodies at and near their junctions with the main veins. Some important oblique faults, crossing the strike of the lode, have in several cases limited ore deposition in particular mines. Whether or not such oblique faults are merely a phase of the post-mineral adjustment, which cut off orebodies, or are pre-mineral faults whose gouges dammed up the ore-bearing channels, is not always clear; but there has certainly been post-mineral movement on some of them.

The definition, extent and importance of post-mineral faulting are debatable and hard to arrive at because of the homogeneous nature of the slate and the absence of characteristic bands or beds that might be used as markers; also to the relatively small extent of vein opened at one time, and the rapidity with which old workings close.

Although the Mother Lode follows the Mariposa slate across the entire county, the developments north of Plymouth and south of Jackson have so far not brought in any mines as important as those in the 10 miles between these towns. A little north of Martell the Mariposa slate is separated into two sections by a lens of the altered andesite from a few hundred feet to one-fourth mile wide and from Jackson southward Calaveras (Carboniferous) rocks are in places in contact with the eastern strand of the Mariposa slate. The Zeila and the Hardenberg have been the principal developments on this side, lying in

the region of the easterly amphibolite schist contact. Between these two mines, there are five or six veins, the Zeila Mine being on the most easterly, the Amador Queen No. 1 occupying several of them of which the 'main vein' showed a width of 60 ft. or more of stringer lead material in the amphibolite schist. There are four such veins or leads in a width of 800 ft. here. No important ore-shoots have been found in this section, between the Zeila and Hardenberg. Quartz is typically in small lenses in the schist here.

The western strip of Mariposa slate running from the Kennedy and Argonaut southeast and south is a very narrow band which carries gold deposits of a kind entirely different than those on the east. South of the Moore Mine this westerly band is known as the Black Metal Belt, containing the Valparaiso, Mammoth and Amador Queen mines, producers of high-grade ore, much of it in specimen form, with arsenopyrite which gives rich concentrate. Besides these three mines which have been the larger producers, the McKinney, Crannis, St. Julian and Marlette claims have also yielded pockets.

#### Geography, Climate, Water, Timber, Power

Amador is the central county of the Mother Lode group, extending from the lower foothills bordering Sacramento Valley on the east, to the summit of the Sierra Nevada. The Mother Lode occupies a rolling, park-like area dotted with small scattered oak trees, crossed by the Cosumnes River on the north county-line and the Mokelumne River on the south, and varying in elevation from 700 to 1600 ft. A broad-gauge railroad from Ione to Martell, the latter directly on the Mother Lode, connects with main-line railroads, and a fine road, part of the State highway system, traverses the length of the lode with good paved highways entering also from Sacramento and Stockton, both about 50 miles distant in the great central valley on the west. The annual rainfall at the Kennedy Mine ranged from 16 to 55 inches during a period of 30 years, with a mean of 33 inches. Snow is nearly unknown. Most of the rain falls between November 1 and April 30 and the other months are dry. The growing season averaged 262 days for 17 years. Summer temperatures of 100° or more are not unusual in July or August, but the humidity is so low that heat prostrations are almost unknown.

**ANALYSIS OF GOLD PRODUCTION OF MOTHER LODE MINES IN AMADOR COUNTY FOR CERTAIN YEARS***

| Year | Number of mines | Tons of ore | Gold and silver,[1] average per ton | Tons conc. | Value conc. per ton | Total value, gold and silver |
|---|---|---|---|---|---|---|
| 1915 | 13 | 815,675 | $4 74 | 17,155 | $79 91 | $3,870,010 00 |
| 1918 | 19 | 492,103 | 6 03 | 23,657 | 44 71 | 2,968,526 00 |
| 1920 | 14 | 199,076 | 8 31 | 3,624 | 104 65 | 1,653,825 00 |
| 1924 | 8 | 311,462 | 8 25 | 2,844 | 114 01 | 2,555,625 00 |
| 1928 | 7 | 286,659 | 8 02 | 5,836 | 79 63 | 2,288,490 00 |
| 1930 | 12 | 233,675 | 7 12 | 4,182 | 78 18 | 1,664,895 00 |
| 1931 | 7 | 213,865 | 6 63 | 3,962 | 75 17 | 1,417,836 00 |
| 1932 | ---------- | 182,650 | 6 67 | ---------- | ---------- | 1,219,794 00 |

* From compilations made by the U. S. Geological Survey and U. S. Bureau of Mines.

[1] With silver at $1 an ounce, the silver content of these ores averages only 5 to 6 cents a ton; in 1932, with silver averaging 28.2 cents an ounce, it amounted to 2 cents a ton.

Though some companies have water rights, the supply comes principally from a public utility which also controls electric-power distribution. The water, used also for generating electricity, comes from reservoirs in the high Sierra Nevada to the east.

Good pine timber is obtainable 15 to 30 miles to the east. Electric power lines, fed from a hydroelectric plant a few miles east of the lode, serve the Mother Lode mines.

**Gold and Silver Production of Amador County, 1880–1933**

| Year | Gold, value | Silver, value | Year | Gold, value | Silver, value |
|---|---|---|---|---|---|
| 1880 | $1,495,053 | $1,953 | 1908 | 1,878,175 | 13,239 |
| 1881 | 1,450,000 | 1,500 | 1909 | 2,298,785 | 16,701 |
| 1882 | 1,500,000 | | 1910 | 2,646,246 | 20,916 |
| 1883 | 1,590.000 | | 1911 | 2,832,395 | 28,899 |
| 1884 | 2,000,000 | 2,000 | 1912 | 2,796,104 | 32,037 |
| 1885 | 2,145,591 | 3,700 | 1913 | 2,901,898 | 18,097 |
| 1886 | 1,874,062 | 6,136 | 1914 | 3,082,002 | 17,032 |
| 1887 | 1,979,956 | 2,069 | 1915 | 3,894,125 | 20,409 |
| 1888 | 1,750,000 | 3,500 | 1916 | 3,660,550 | 18,705 |
| 1889 | 1,560,975 | 6,398 | 1917 | 3,664,164 | 21,358 |
| 1890 | 1,459,952 | 9,357 | 1918 | 3,249,385 | 29,590 |
| 1891 | 1,395,962 | 13,895 | 1919 | 2,920,492 | 33,254 |
| 1892 | 1,210,383 | 8,008 | 1920 | 1,788,793 | 19,780 |
| 1893 | 1,505,973 | 5,230 | 1921 | 2,167,443 | 35,460 |
| 1894 | 1,331,916 | 280 | 1922 | 2,241,100 | 32,287 |
| 1895 | 1,391,929 | 1,089 | 1923 | 1,734,133 | 15,153 |
| 1896 | 1,523,351 | 3,767 | 1924 | 2,706,508 | 18,251 |
| 1897 | 1,324,472 | 3,477 | 1925 | 2,338,101 | 16,123 |
| 1898 | 1,806,363 | 1,742 | 1926 | 2,167,275 | 13,422 |
| 1899 | 1,544,868 | 6,902 | 1927 | 1,922,714 | 11,319 |
| 1900 | 1,373,788 | 14,915 | 1928 | 2,236,922 | 14,317 |
| 1901 | 1,823,827 | 7,444 | 1929 | 1,601,861 | 9,392 |
| 1902 | 1,629,151 | 2,686 | 1930 | 1,840,191 | 7,100 |
| 1903 | 1,609,744 | 4,336 | 1931 | 1,549,073 | 4,783 |
| 1904 | 2,060,574 | 4,055 | 1932 | 1,307,760 | 3,865 |
| 1905 | 2,445,815 | 17,930 | 1933 | 1,945,261 | 6,471 |
| 1906 | 2,260,373 | 14,579 | | | |
| 1907 | 2,116,182 | 13,515 | Total values | $110,529,806 | $638,323 |

*Alpine* (Wheeler) prospect adjoins the Plymouth on the north, the shaft being only about 300 ft. north of the north end line of the Empire. This claim was opened in the 1860's and the stock was traded in at San Francisco in the early 1870's, when there was a 10-stamp mill on the claim. After a depth of 400 ft, had been reached and $78,000 had been paid in assessments with no dividends, work was stopped. A few thousand dollars was produced in 1895, after which the claim was idle until 1910. The deeper shaft was subsequently sunk to 600 ft. on an incline of 55°, the deeper levels being at 500 and 600 ft. There was also another shaft, 200 ft. deep. No important orebody was found and work stopped in 1914.

The Mariposa slate on this claim is cut by the Alpine greenstone dike, which here dips about 52° SE. and strikes nearly NE. The shaft struck this dike at a depth of about 200 ft. and followed the greenstone on its hanging-wall side to the bottom. A vein called the Alpine was found at this contact and followed on a curving course 700 to 800 ft. northeast. It may be a spur of the Empire vein. At a point 80 ft. west of the shaft on the 500-ft. level, the Alpine vein joins and is terminated by a vein striking north, persumably the Empire vein, on which considerable prospecting was done.

The greenstone-slate contact is near the Plymouth end-line on the 600-ft. level.

*Amador Gold (Aetna)* is 1¼ miles south of Jackson. Most of the work was done before 1900. A wide vein of quartz occurs at the contact of Mariposa slate (footwall) and amphibolite schist (hanging wall). An inclined shaft was sunk 700 ft. by 1890. Levels were turned at 350, 450, 550 and 650 ft. and some stoping was done, but production was evidently small, that of record amounting to only a few hundred dollars. At least 750 ft. had been drifted by 1890 on the 550-ft. level.

There was a 60-stamp mill on the Aetna.

The Moore Mine lies a little west, and when it was last worked the Aetna vein, or one so named, was prospected. (See Moore.)

*Amador Queen No. 1,* two miles south of Jackson, was extensively prospected between 1890 and 1901 by Jackson Gold Fields and Jackson Exploration and Development Company. The only recorded production was a few hundred dollars a year during the above period from rock taken out in the course of prospecting.

The shaft was sunk 1250 ft. on an incline of about 65° on the contact zone, with amphibolite schist hanging wall and slate footwall, there being first Calaveras rocks, and farther west Mariposa slate on the footwall side. Hunts Gulch is believed to be the surface expression of a strike fault. Drifts were run north 500 ft. or more on the 400-, 500-, and 800-ft. levels, and drifting was also carried south on these levels for an unknown length. A west crosscut was also run 250 ft. on 500-ft. level, where a vein 28½ ft. wide was reported, but too low grade there to pay. The workings were said to be nearly all in amphibolite schist, closely folded and twisted, and with many seams and lenses of quartz. Average grade must have been quite low.

*Amador Queen No. 2* is two miles south of Jackson on the narrow band of Mariposa slate called locally the 'black metal belt.' The Valparaiso and Mammoth mines are similar geologically, lying on the same belt, all three being known as producers of 'specimen' ore with arsenopyrite.

The Amador Queen No. 2 was opened by a crosscut adit 1200 ft. long which reached the slate-greenstone contact. From here a drift was run 1000 ft. south and 460 ft, north. An internal shaft was also sunk 900 ft. on the dip of the slate, 62° E., giving a total inclined depth of 1212 ft. Levels were run at 500 and 700 ft. in depth in the shaft. In late years, however, the shaft has been under water and the work at time of last visit was in a raise near the end of the south drift on the adit level. This mine has been worked every year in a small way since 1918; before that, operation appears to have been irregular, although the greater part of the underground workings had been run by 1900. The production reported in late years has been mainly from high grade and often from 'specimen' ore and has averaged a few thousand dollars a year.

The interlayered schist and slate seen in the accessible workings showed no pronounced fissures or gouges. The formation being mined at the time near the south end of the workings was a very hard, blocky, siliceous schist. The band said to carry gold there was a strip of slate

about 4 ft. wide, containing gold-bearing stringers of white quartz which terminate at the walls of their immediate slate band. The gold occurs with arsenopyrite and the concentrate sometimes is worth several hundred dollars a ton, although occurring in only small quantity.

*Amador Star (Rhetta) Mine,* 3 miles north of Plymouth, covers 130 acres (agricultural patent) in Sec. 23, T. 8 N., R. 10 E. Previous to 1900, it had been worked through a shallow crosscut adit, which struck the vein 422 ft. from the portal, going nearly due west; thence running south 37 ft. and south of southwest 137 ft. Some ore was mined about this adit (to a depth of 100 ft.) and crushed at the Bay State mill; the amount and value are not known as the two were worked by the same company. Two veins were reported; one at the contact of Mariposa slate hanging wall and greenstone (altered diabase) footwall, and the other branching from it and running nearer north in the slate. The mine map, however, shows only one, although Storms reported that "Both of these veins have been explored with satisfactory results."

After the adit mentioned was driven, a vertical shaft was sunk about 1917 to a depth of 580 ft. with one level at 500 ft. from which a crosscut was driven 150 ft. to the greenstone and slate contact. Along this a drift was run 470 ft. north and 150 ft. south, following a small vein which gave low assays. These workings did not connect with the old adit, although the north drift runs almost 100 ft. beyond the old adit. Several crosscuts were run west to the greenstone on the 500-ft. level without finding ore.

The assays on the adit level indicated that a length of a little over 100 ft. showed promise of producing ore below. The fact that the downward extension of this ore was not encountered on the 500-ft. level raises a question as to whether the ore passed into a fissure in the slate, or raked away from the lower workings. In 1931 Amador Star Mining Company began work from the 300-ft. point in the shaft and reported striking a promising prospect 225 ft. west. On account of lack of funds, water had been allowed to rise again above this point at time of visit, so it could not be seen.

Since the above was written, the property was leased with option to purchase to Arthur Hamburger, who did considerable work under the title of Hamburger Mines. This included a crosscut run about 1000 ft. eastward on the 500-ft. level in search of a hanging-wall vein. No such vein was found, the rocks penetrated consisting of Calaveras schists with the interbedded igneous rock showing flow structure in places, which is occasionally seen in this formation. Some work was also done on the 300-ft. level which was 670 ft. long early in 1933; and on 500-ft. level, mostly clearing old workings or running new ones parallel to the old. A mill was erected using the flotation system (see under Metallurgy). Hamburger later formed the West American Consolidated Gold Mines and about 40 men were employed when the place was visited June 15, 1934. Work in the levels had been stopped pending the sinking of the shaft to a depth of 900 ft. The mill was also to be closed temporarily.

The vein on the 500-ft. level is reached by a crosscut 150 ft. north. On this level former operators had drifted 150 ft. south and 750 ft.

north. The present company ran a drift parallel to the old one on the south, and are reopening the old north drift. In the south drift, two raises for stopes have been started. The vein in the face shows 2½ ft. of quartz, a small fault there showing the upper segment thrown its width horizontally eastward and only about one foot vertically downward. Elsewhere it shows greater width, increasing northward to a maximum of 8 to 9 ft. in a distance of 400 ft. Where it has this width, it consists of a strand of quartz on each wall separated by several feet of slate and quartz stringers with considerable pyrite. The superintendent claims heads worth about $6 a ton from the small amount of rock milled.

*Anita* or *Bright Mine* is one-half mile southwest of Jackson. The surface was worked in early days, but no depth was reached until Anita Gold Mining Company began sinking in 1895. They sank an inclined shaft at an angle of 63° in and near the contact of the footwall greenstone and the narrow strip of Mariposa slate which extends south from the Argonaut Mine and carries the western branch of the Mother Lode. The shaft was started in slate but at 125 ft. struck the altered greenstone. At the 500-ft. level it required a crosscut 75 ft. long to the vein, and below there was in very hard greenstone.

Levels were run but details of these are lacking except for the one at 500 ft. Here, after the crosscut was run, drifts were extended north and south a total length of 700 ft. An ore-shoot 114 ft. long was claimed by the promoters on that level, but on account of a heavy flow of water encountered there, the level was closed by bulkheading and the shaft was continued to a depth of 770 ft., where work appears to have stopped, without any record of production.

### *Argonaut Mine*

#### History

Originally known as the Pioneer, this mine was first worked in 1850, but received little attention for many years; in 1876 the depth reached was only 150 ft. and there was no mill, although the adjoining Kennedy workings had been brought up to the property line, where the Pioneer ore-shoot was known to be 18 ft. wide. Most of the early work on the Pioneer was through an adit on the northern end of the claim. Argonaut Mining Company was incorporated in 1893. Operation has been continuous since except for interruptions caused by fires. In the sping of 1919, one started which was not brought under complete control until the lower workings of the Kennedy and Argonaut had been flooded. This caused a loss of a year's time. Again, on August 27, 1922, a fire from some unexplained cause began near the 3350-ft. level and caused the loss of 47 lives on the 4650- and 4800-ft. levels. Milling of ore was interrupted again for about a year at that time.

#### Production

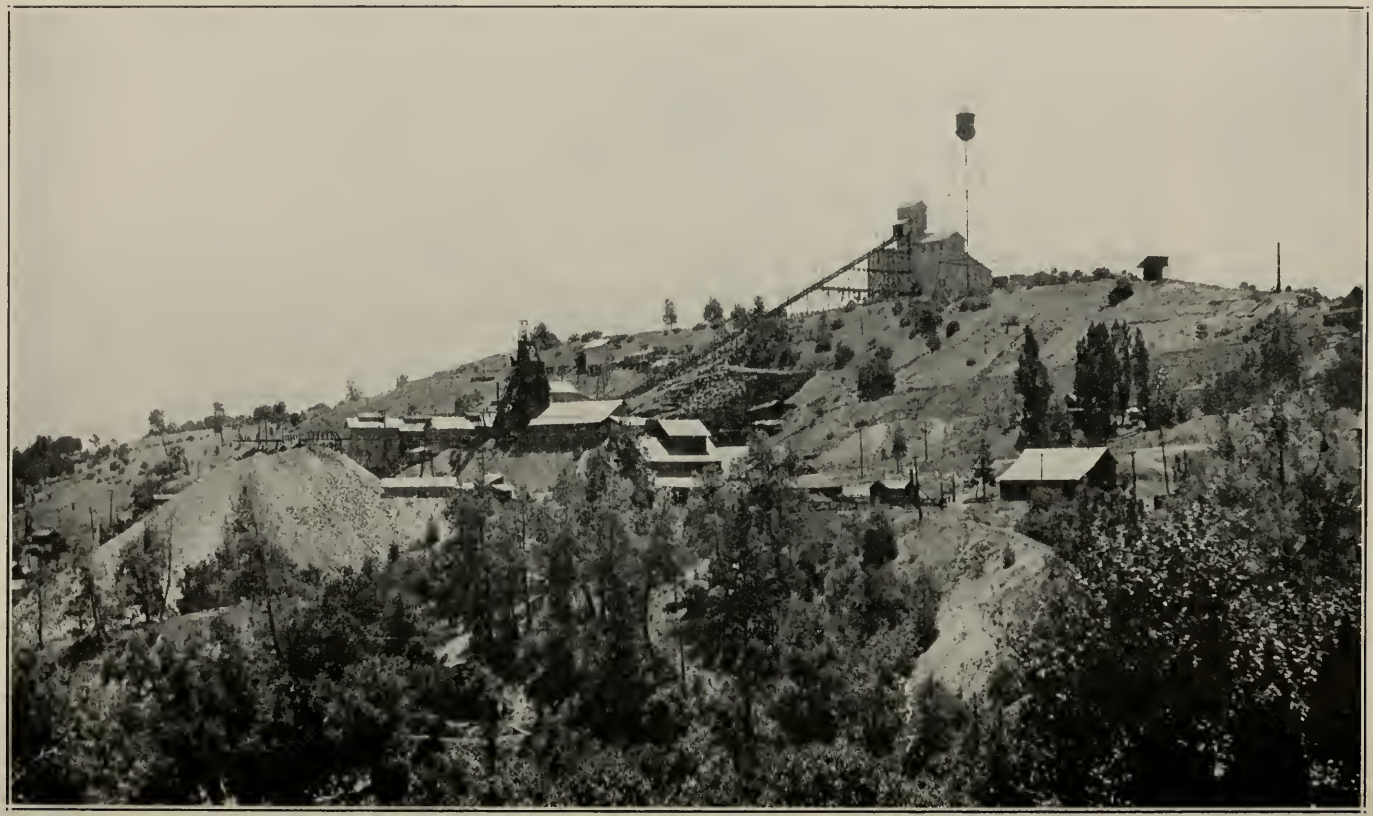
The total production reported by Argonaut Mining Company has been about $19,000,000. The tonnage of ore handled yearly since 1910 (except for 1920, 1921 and 1923) has been from 62,000 to 91,000 tons.

The best section of the mine was between the 3400-ft. and 4800-ft. levels, where mining between 1914 and 1920 yielded ore which averaged from $10 to $13 a ton. The average value both before and since that period has been lower; a total of 914,466 tons of ore yielded $7,702,705 between 1913 and 1926. The production until 1932 has been entirely from the Pioneer claim. Dividends paid have exceeded $3,000,000.

Geology

The geology of the upper one-third of the mine has been described in past publications of both the State Mining Bureau and U. S. Geological Survey, which both stated that the vein occupied a fissure apparently opened by a reverse fault in which the hanging wall had been thrust up about 125 feet as indicated by displacement of the Mariposa slate in the raise from the 470-ft. level to the old Pioneer adit. Here should be mentioned the argument of Kennedy Extension Mining Company in their suit with the Argonaut Mining Company. About 1200 ft. in depth on the Argonaut fissure, a vein branched into the hanging wall. The former company contended that this was the older vein, which had been displaced about 700 ft. by normal faulting as measured along the Argonaut fissure. The plaintiffs lost this suit.

The upper part of the vein to a depth of 290 ft. is in altered greenstone, which has been classified variously as diabase, meta-andesite and augite-melaphyre tuffs and breccias. Near the vein the greenstone has been rendered schistose, and is locally termed amphibolite schist, a term sanctioned not only by local usage but by geologists. Knopf prefers to accent the changes in the greenstone due to hydrothermal alteration, and points out that it is merely a facies of the greenstone. He found much ankerite in it. From 290 ft. to about the 470-ft. level, the vein traversed a narrow belt of Mariposa slate, and from there to 2500 ft. deep was on or near the contact with Mariposa slate footwall and the schistose altered-greenstone hanging wall. From there downward for the most part the footwall country rock is hard gray schist, but with a casing of black slate between it and the vein, and the hanging wall is Mariposa slate. Where seen on the 4800-ft. level the slate casing on the footwall was 10 ft. thick but in places is from 20 ft. to 40 ft. thick, varying with the weaving courses of the footwall contact and the strike of the vein. On the 4350-ft. level the vein strikes N. 18° W. and dips 63° northeast, with slips in both the walls about parallel to the strike of the vein, but those in the hanging-wall slate dipping about 80° northeast. On the 4500-ft. level the footwall contact strikes N. 20° W. and dips northeast 60° to 63°. On the 4800-ft. level the shaft crosscut to the vein crosses a pronounced slip with hard, blocky gray schist on the hanging-wall side and slate on the footwall. This slip is 125 ft. east of the true footwall, strikes N. 30° W. and dips 75° northeast. The vein, close to the footwall, has the normal strike of about N. 18° W. and dips 60° northeast. To properly correlate the geology of the Argonaut and the neighboring Kennedy on the north, it should be remembered that the Argonaut has the main footwall vein only, while in the Kennedy the breaking away of an immense horse of rock led to the formation of a hanging-wall vein also. Sills of greenstone, now standing nearly vertical, and entirely altered to schist,



Argonaut Mine and Mill, near Jackson.

*Photo by C. A. Logan.*

occur within the Mariposa slate and on certain levels, as a result, the immediate hanging wall is greenstone and the footwall slate, as on the 3700-ft. level.

On that level the fissure was seven to ten feet wide and was one-half filled with gouge and half with quartz. Between the 3600- and 4200-ft. levels, because of its north pitch, the north ore-shoot was in the Kennedy, then returned to the Argonaut. On the 4200-ft. level the vein was 20 feet wide; on the 4350-ft. level it was 30 feet wide, and continued wide in the south drifts in the deeper levels. Though most of the earth movements have resulted in crushing the slate, the footwall schist is in places shattered, and traversed by numerous quartz veinlets and occasional slips about parallel to the main vein, the schist being reduced nearly to gouge along these slips. The complete tracing out of the faults in this or any of the other large mines on the lode would require careful study at frequent periods over a number of years as the development work went on. Besides the pre-mineral strike fault of the lode, and the accompanying slips, there have been important oblique faults in the Argonaut property, and post-mineral faulting within the vein. The 4500-ft. north drift 150 ft. south of the Kennedy line showed the vein 15 ft. wide with a width of six ft. next the hanging wall dragged down. On the south on many levels the ore had been considered as bounded by an oblique fault. This strikes northwest and its trace on the plane of the vein dips 70° to 75° northeast, judging from the positions where it was encountered on many levels. On the 4500-ft. level, about 200 ft. south of the shaft crosscut, there was a length of about 200 ft. of broken and crushed ground as a result of this fault. On the 4650-ft. level, the vein was stoped 480 ft. in length when the crushed ground was encountered. This extended for 75 ft., and ore was found south of it, showing, when visited, 25 ft. of quartz of which the hanging-wall part was solid white quartz, with the best ore consisting of a few feet of ribbon rock on the footwall side. On the 4800-ft. level the vein widened rapidly south of the region where the fault had been found on the levels above. From a width of a few feet on the north, the vein increased in width to 60 ft. on the south, and there was stoped 30 to 60 ft. wide. The stope length on this level was over 1000 ft. On the 4950- and 5100-ft. levels the vein is reported much narrower, and the ore-shoot has apparently shortened and become flatter, approaching the shaft, which is in the hanging wall of the vein. The manager reported also a lower average grade of ore and ground increasingly hard to hold open, resulting in an operating loss in 1926. The ore conditions did not improve materially again until the 5550-ft. level. Here a junction of two veins gave a large, low-grade quartz body on the north. Some ore was found on the south, however, this being the top of a new ore-body. On the 5700-ft. level, the north drift showed ore from 6 to 17 ft. wide for a length of 200 ft. up to the Kennedy line. In the south drift on this level, three ore-shoots, 158 ft., 235 ft., and 170 ft. long respectively, varying from 5 ft. to 12 ft. in width and from $3 to $12 a ton in value, were found, the last still showing in the face. At the time of visit in 1932 the 5800-ft. level had been opened for 1100 ft. and the ore being mined from day to day from both drifts showed many variations, but held up well in value on the north shoot.

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The recent work in the Argonaut has given such encouraging results that at the middle of 1934 the operators were optimistic about the future and were planning prospecting work to determine the possibility that hitherto unsuspected ore reserves might exist in the undeveloped section above the present bottom.

The winze from the 5500-ft. level, 300 ft. south of the shaft, has been deepened and levels have been opened at 5500, 5700, 5800 and 6000 ft. inclined depth. Late in June, the 6000-ft. level had been drifted 950 ft. and the 5800-ft. level 600 ft.

The upper ore-shoot, which had been the mainstay of the mine for so long, split into two branches near the 5400-ft. level, and these were worked separately below there. The southerly limit of this ore on the 5700-ft. level was 500 ft. south of the winze. From there the south drift was advanced on the footwall side, and at 250 ft. a crosscut was run toward the vein, entering a section of faulted ground carrying some good ore in the drag. The fault conditions at that time were not understood. Later work brought out the fact that this crosscut was in what is now called No. 3 fault, the southernmost of three such so far discovered. No. 1 fault had been known since the early history of the mine, and had generally been regarded as a boundary for ore. This fault had a horizontal throw at the most of 80 ft. on the 2880- and 3000-ft. levels, and has persisted with depth. No. 2 fault, south of No. 1, was found to have a horizontal throw of 50 ft., or 80 ft. on the drag on the 5700-ft. level, and No. 3, which is 200 ft. south of No. 2, has about the same horizontal throw of 50 ft. Each of these faults have moved the vein segments east, looking south. In June the company reported 200 ft. in length of ore between No. 2 and No. 3 faults, and 200 ft. between No. 3 fault and the south face, where the vein was 9 ft. wide. In this drift the vein was reported from 9 to 16 ft. wide. The grade of ore in this shoot so far is reported about the minimum that could have been worked at the old price of gold, i.e., $6 to $7 a ton.

On the 6000-ft. level, the assays in the region of the old ore-shoot are low-grade, but in a raise which was 40 ft. above this level in June, 1934, some very good ore was being found. This was 9 ft. wide and shows strands of heavy sulphide (pyrite and galena chiefly), sufficient to raise the sulphide content far above average. Ore recently has been coming from levels between 5500 and 6000 ft.

A crew of 225 men in all was employed in 1934 up to the time of the strike, October 2. About 180 of these were working underground. The mill has been crushing 8000 tons a month. There does not appear to be much change in the character of ore at this depth except as noted on the 6000-ft. level. About 150 tons of sulphide concentrate is produced monthly. Both walls in the bottom are still reported to be Mariposa slate.

A storage battery locomotive, hauling six 1-ton cars, has been put in use lately on the 5500-ft. level between the winze and main shaft. An Eimco mucking machine (the first used in a Mother Lode quartz mine) has also been installed and has been operated chiefly in drifting on the 6000-ft. level.

Ore

The ore is generally best within a few feet of the footwall where it is of a ribboned structure which indicates repeated reopening movements and filling along that wall. Specimen rock is found at times. Some of the ore in the south shoot which had the appearance of massive, barren quartz gave surprisingly high assays. The ore has of course considerable admixed black slate as it goes to the mill, but due to the width of the quartz vein in this mine the proportion is less than in many cases where stringer leads are mined. Ore has remained free milling to the great depth reached, in the sense that most of the gold is released by proper crushing and can be saved by amalgamation. In 1931, when 61% of ore came from the 5700-ft. level and 32% from the 5550-ft. level, the concentrate formed 2.4% of ore milled, and yielded 22% of the gold saved and 28% of silver. The gold content of concentrates has ranged from 2.6 oz. to 5 oz. per ton, varying with the grade of ore. As the grade of ore decreases the amount of silver in the concentrate, never important, appears to increase to about 1 oz. per ton, possibly due to a little higher proportion of silver in the sulphides of the wall rock, of which more is likely to be milled when the vein narrows. Pyrite is by far the most plentiful sulphide. Galena is always favorably regarded, as is also arsenopyrite. Pyrrhotite, chalcopyrite and tetrahedrite also occur sparingly. Three periods of sulphide mineralization are noted; 'paint' sulphide, which is worthless, another with a glossy look, is low grade. Over a long period, there is no such thing as an average grade ore in these Mother Lode mines. The paper average of $8.42 a ton for the Argonaut between 1913 and 1926 on a total of nearly a million tons conceals variations of several dollars a ton. As noted, *ante,* under Production, the best ore found in large quantity, was between the 3400-ft. and 4800-ft. levels and averaged $10 to $13 a ton.

Mining Conditions and Methods

The inclined shaft of the Argonaut has three compartments, one for manway, pipes, etc., and two for hoisting, each being 4 ft. 1 in. by 5 ft. 9 in. in the clear. Dip of the shaft is 63° to the 1650-ft. level. The vein was flat for the first few hundred feet from the surface and there lies under the shaft which crosses it at the 290-ft. level. From the 470-ft. level downward, however, the vein steepened so that the shaft crossed it again at 1650 ft. and below there is in the hanging wall. From 1650 ft. to 4050 ft. the shaft has an inclination of 57°, then steepens again to 63°, so that it remains at about a constant distance from vein in the deeper levels; the crosscuts from shaft to vein are 215 ft. long on the 4950-ft. and 5250-ft. levels. The nature of formations required heavy shaft timbering and 'Oregon pine' (fir) 20 by 20 inches was used for most of it, but lately somewhat smaller sizes have been thought sufficient, where the ground is not heavy or broken. This shaft is 5700 ft. inclined depth. On the 5550-ft. level, 225 ft. south of the main shaft and in the footwall, a station was cut, another hoist installed and sinking was resumed, with the 6200-ft. level as an early objective, although the hoist will permit going much deeper if desired. Levels are 150 ft. apart.

The ground is heavy, particularly along the vein, so that very little space can be left open while stoping. Parts of shaft crosscuts in hard schist are the only exceptions to the heavy timbering which forms one of the principal items of mining expense. Drifts to prospect the vein and prepare for stoping are usually run one set wide along the footwall with a pillar left along the hanging wall, which is later taken from the next lower level. Posts of drift sets are of local round pine, from 12 to 24 inches in diameter and caps are 12 in. by 12 in. Posts are spread to withstand side pressure. In lagging, space is left to permit gouge and fine rock to squeeze out and relieve pressure. Modified square-setting with waste filling was standard practice until 1925–1927 when a form of vertical slicing was tried. This had to be abandoned and the old method resumed. In these square sets round posts 14 in. to 18 in. in diameter, caps 12 in. by 12 in. and girts from 8 in. to 12 in. are used. Waste filling taken from chambers in the walls is kept up to within one set of the stoping work. Even with this, the ground will soon begin to squeeze. The heavy ground discourages much advance development, and induces as rapid stoping as possible, once a block is opened. These ore blocks are generally worked in sections about 100 ft. in length above the drift at a time, with ore chutes 25 ft. apart.

Ore is drilled with 1-inch stopers, blasted with 30% gelatin dynamite, and hand trammed to shaft ore-pockets in 1-ton cars. Skips running in the main shaft are operated in balance so far as possible, by a geared hoist having drums 8 ft. by 47 inches using wire rope $1\frac{1}{8}$ in. in diameter, and made of 6 strands of 19 wires each of crucible steel with a hemp center. Power is furnished by a 500 h.p. 60-cycle, 3-phase induction motor, operating at 440 volts, with a master switch and liquid rheostat. Though the hoist is of 72 cubic feet capacity, the average load of ore hoisted in 1931 was 7464 pounds.

### Milling Methods, Recovery

Ore generally, because of its friable nature and the blasting practice, reaches the surface grizzley rather fine; oversize plus $2\frac{1}{2}$-inch, is broken in a jaw crusher in the headframe, is weighed and taken to the mill bins by a tramway. These bins hold 2200 tons. Ore is fed by Challenge feeders to the 60 stamps, weighing 1285 lb. each newly shod. Battery screens are of No. 30 brass wire with openings of 0.0277 inch. Stamps drop 8 inches 96 times a minute, and discharge averages 7 inches high. These stamps were made in 1916 by Knight & Company of Sutter Creek. An 85 h.p., 60-cycle, 440-volt induction motor is used for each 20 stamps.

Some years ago (1922–1928) this company installed Dorr classifiers, Deister and Wilfley concentrators, cones and tube mills for regrinding. Lately they have taken all this equipment out of use and have returned to the simpler flow sheet. After inside and outside amalgamation, pulp passes to spitzlutte, one for each 5 stamps, and each of these deliver different sized products to each of two improved iron-frame Allis Chalmers vanners. Overflow from spitzlutte goes to a Callow cone from which underflow passes to a third vanner; three vanners thus handling the product of each 5 stamps. Vanner tailing

and overflow from cones pass through a pipe to the cyanide plant of Amador Metals Reduction Company. Vanners require about 1 h.p. each. Concentrate is shipped for smelting. In the long run over a period of many years, the mill extraction under the method described does not appear to have varied materially from the more elaborate one using tube mills, late model concentrators, etc. Recovery in the mill has ranged from below 84% to 91%. Both of these extremes were had when using the tube mills. When using vanners, the average extraction was from over 85% to 89%. Metallurgists are prone to account for this condition by assuming that foremen and millmen accustomed to nothing but vanners cannot or will not get maximum results with machinery which requires more attention and greater skill. But the difficulty is also largely due to the association of most of the gold lost with carbonaceous slimes. In the cyanide plant of Amador Metals Reduction Company the sand and slime are first separated in a Dorr classifier, and are separately cyanided, as described in more detail in the chapter on Metallurgy.

### Costs for 1931

Mining cost, per ton mined (operating costs):

| *Item* | *Amount* |
|---|---|
| Mining | $1.913 |
| Development | 1.033 |
| Hoisting | .511 |
| Surface | .448 |
| Repairs, maintenance | .859 |
| Total | $4.764 |

Distribution of mining costs (operating):

| *Account* | *Amount, per ton mined* |
|---|---|
| Labor | $3.307 |
| Timber | .353 |
| Power and water | .336 |
| Explosives | .139 |
| Hardware and supplies | .437 |
| Insurance | .015 |
| Accidents | .111 |
| Freight, etc. | .066 |
| Total | $4.764 |

Distribution of milling costs:

| Account | Amount, per ton milled |
|---|---|
| Power, water, lights | $0.196 |
| Labor | .266 |
| Treatment of concentrate | .349 |
| Hauling | .024 |
| Hardware and supplies | .081 |
| Insurance | .015 |
| All other expense | .026 |
| Total | $0.957 |

Recapitulation:

| | |
|---|---|
| Mining cost, operating | $4.764 |
| Milling cost, operating | .957 |
| General | .488 |
| Total | $6.209 |

*Ballard Mine* (Ballard and Martin). Mrs. Maria Ballard, owner. Leased to John F. Ratto with option to purchase. Comprises E½ of W½ of Sec. 14, T. 8 N., R. 10 E., containing 160 acres under agricultural patent.

Although considerable work was done in early days here, including the sinking of several shafts and some stoping there is no available record of results. In 1928, Lopez Mining Company put a 10-stamp mill at the main shaft and reopened that shaft and the 200-ft. level, extending the latter south. They failed and the property lay idle until late in 1932, except for some shallow work by lessees. Early in February, 1933, about 10 men were employed. The south drift on the 200-ft. level was then 175 ft. long and being extended; on the north, an old drift had been reopened on the same level for 80 ft.

The west vein is reached by a crosscut 430 ft. long from the shaft on the 200-ft. level. The workings are in Mariposa slate. An ore shoot about 50 ft. long is claimed in the south drift, near the crosscut. It has not been explored except on this level, so far as known. Farther south, the drift was turned away from the apparent course of the vein, as indicated by holes lately put in the west side of the drift. The quartz so revealed is to be prospected. The Spanish shaft is 70 ft. deep and is about 150 ft. ahead of the south face; and some large outcrops of quartz could be prospected at depth by running this level 350 ft. south. On the north, 500 ft. from the shaft crosscut, an old adit cut a vein 16 ft. wide which is said to offer inducements to carry the north drift ahead on the 200-ft. level to prospect it.

A light 5-stamp mill with one concentrator was being completed at time of visit, on a hillside 600 ft. south of the main shaft, and above it. This will permit mill tests of quartz from nearby outcrops and from old shafts sunk years ago. At main shaft there is a portable compressor, two 4-cylinder gasoline engines and a single drum hoist.

Early in 1934, a decision in favor of Ratto was rendered in a quiet title action against H. L. Berkey and Ballard-Plymouth Gold Mines Co.

*Bay State Mine,* four miles north of Plymouth, was opened in the early 1890's, the shaft having been 300 ft. deep in 1892. Water was struck in such quantity that the drifts on the 300-ft. level were closed with concrete bulkheads in 1893, and shaft-sinking was continued. A 10-stamp mill was erected and early in 1895 was running steadily on ore stoped between the 600-ft. and 500-ft. levels. Late that year ore was being mined from four places on those levels and was said to be paying a little more than expenses. This ore was stoped from the 600-ft. to 400-ft. level by Bay State Mining Company. The total reported production from 1892 to 1897, inclusive, was about $34,000. This company quit work at 750 ft. in depth about July, 1897. Work was resumed in 1899 but no more production was made until 1900 when Globe Mining and Milling Company took control. From then until 1905 production was small and irregular, amounting to about $24,000 in all. The main shaft reached a depth of 1065 ft. on an incline of 81°, and was 4½ ft. by 9 ft. in the clear. Levels were run at 300, 400, 500, 600, 750, 830 and 1030 ft. The last production was in 1909 but the exact amount is unknown as it was worked in connection with the Rhetta.

The shaft was sunk between the West and Middle veins, and the principal work was on the latter, also called the Bay State vein. The Kretcher or West vein was reported to have been reached by a crosscut 350 ft. long from the 300-ft. level, and by longer crosscuts on the 750-ft. and 1030-ft. levels. The Bay State vein was opened for a length of about 300 ft. on each side of the shaft on the 1030-ft. level, and Kretcher vein was prospected for a length of 200 ft. in each direction on 750-ft. level, also 250 ft. north and 300 ft. south on 1030-ft. level. If any ore was stoped from the latter, there is no separate record of it at hand. It is stated that a raise was run from the 1030-ft. to 700-ft. level on this vein. The veins are said to average 4 ft. thick but in places reach 12 ft. in thickness. It has been stated that work in 1899 on the C. Kretcher property south of the Bay State indicated that these two veins join there. The strike of main vein is N. 15° W. and dip 76° E.

There is also stated to be an east vein, called the Vaughn, which was struck in a crosscut from the bottom level, but water caused trouble at this face also. Definite details are lacking, but considerable low-grade rock is claimed to exist in the mine.

There is no equipment on the property. It is on an agricultural patent.

Late in 1934, this mine was being unwatered by West American Consolidated Gold Mines.

*Bellwether Mine,* one-half mile north of Jackson on an agricultural patent 600 feet by 3200 feet on the East (or Zeila) vein, was developed by Bellwether Mining Company between 1895 and 1900. Previously it had been prospected by several shallow shafts, the deepest 180 feet deep. The later work included an inclined shaft 320 feet deep with crosscuts and drifts to prospect the wide vein, which is the east or hanging-wall branch of the Mother Lode, carrying ore similar to the Zeila Mine, on the south. On the 282-ft. level, a crosscut was run east 130 feet, and it was claimed the lode was found to be 85 feet wide and was reported to show fairly good assays for a width of 40 feet. Noth-

ing more is known of the claim, which later was bought by the Kennedy Mining and Milling Company.

*Bunker Hill Mine (South Mayflower)*

History and Production

Originally called the Ranchoree or Rancheria Mine, under which name work started in 1853, the Bunker Hill claim was first worked by open cut, then opened through the south shaft, 350 ft. from the Little Amador line. In 1863, Bunker Hill Quartz Mining Company was organized and the south shaft was sunk to 450 ft. on the incline in the next few years. Later the north shaft was started 360 ft. from the first and both were in use many years. Soon after the beginning of work a 12-stamp mill had been built. The ore in the upper workings was often rich, as between the 170-ft. and 270-ft. levels, where it is said to have yielded $50 to $75 a ton. Most of the ore came from the vein in slate, although a drift on the hanging-wall vein in greenstone is said to have yielded in one place "$2,000 in gold for every barrel full." At 350 ft. the vein was reported 6 ft. wide and yielded $10 a ton with a working cost of $7 a ton. A 40-stamp mill and a chlorination plant were built in 1880, and the next 10 years were devoted to working out the ore in the Mariposa slate. By 1888, the north shaft reached a depth of 800 ft. on the incline (680 ft. vertical). The mill was crushing an average of 99 tons a day. Mining cost $3.35 a ton, milling 60 cents and chlorination treatment of sulphides (then 2% of ore) $14.61 a ton. Knopf[1] quotes Elisha Hampton, former Superintendent, as saying the mine produced $1,272,000 prior to 1891. In that year only $7,386 was taken out.

By 1893, the mine had been idle long enough to permit the main shaft to cave and the plant to deteriorate. It was re-named the *South Mayflower* and a reopening was begun, the *Mayflower* and *Nevada* claims being consolidated with it about this time. In 1894 the group produced $30,000 and in 1895 a claim on the hanging-wall greenstone known as the *East Mayflower* yielded $5,000. In 1899, Bunker Hill Consolidated Mining Company was organized and worked steadily until late in 1922.

At 800 ft. in depth, the principal channel of mineralization entered the greenstone and the larger part of ore thereafter was 'grey ore,' entirely different from and much lower in average gold content than the slate-quartz ore mined above. During this period, 887,585 tons of ore yielded $3,834,550. The last production amounted to $5,446 in 1925. This gives a grand total of $5,154,382. During 11 years prior to September, 1916, this mine paid 123 dividends, said to have amounted to about $1,000,000 or about 5 times the amount of the capital stock ($200,000 par value). Assessments were levied after 1916 but their amount is unknown. Profit stopped with ore at $4 a ton.

Mine Workings and Geology

The most profitable operations at this mine, as at most of those on the lode, were on orebodies in the black Mariposa slate at the metandesite contact, known here as the hanging-wall vein or Bunker Hill Vein.

[1] U. S. Geol. Survey, P. P. 157, p. 55.

The footwall of this vein was usually the soft, swelling slate, and hanging-wall greenstone (meta-andesite) although the wall rocks were in places both slate, or the footwall greenstone, due to the vein crossing interlayered bands of slate and greenstone. The work between the 1950-ft. and 2800-ft. levels is on the hanging-wall vein, and this same vein was being prospected in the winze workings below 2800 ft., where the hanging wall is hard meta-andesite, in places altered to schist. The ore in this vein is a black gouge ore with quartz stringers. This vein was stoped above the 2400-ft. level, where the orebody was of a maximum length of 800 ft. and a maximum width of 10 ft., averaging five to six feet. There is still considerable low-grade ore left above the 2800-ft. level.

The upper slate orebody, as noted above, had been worked out by 1891 down to the 800-ft. level. The 'grey ore' body was first found on the 1400-ft. level and was worked for a length of 420 ft. there, extending 280 ft. south of shaft. Where first found it was 40 ft. west of and about parallel to the Bunker Hill vein. The ore lenses occupied a wedge-shaped section, entering the hanging-wall vein on the north. It had a maximum length of 850 ft. and average width of 30 ft. but was in places 125 ft. wide. It was worked down to the 1950-ft. level. This 'grey ore' was formed by the hydrothermal alteration of the greenstone. It contained up to 4% of sulphides principally pyrite. It furnished the bulk of profitable tonnage during the last company's operations.

Most of the later work was north of the shaft, and below the 1950-ft. level on the hanging-wall vein. This vein here is a crushed gouge of slate and quartz stringers with some large bodies of low-grade massive quartz. In the 2200-ft. level north drift there was a width of 30 ft. of barren quartz on the hanging wall, with 4 ft. of ore on the footwall, the two sections being separated by a gouge seam. From the 1950-ft. level to 2800-ft. level, lengths of from 1450 ft. to 1778 ft. (by co-ordinates) were drifted northward on the hanging-wall vein, all the later operations having been devoted to a search for more high-grade ore in it. At the time of last visit the 3200-ft. level had been run 100 ft. each way and the 3400-ft. level 350 ft. north and 100 ft. south on the same vein. It was found to vary from a few inches to over 30 ft. in width. Near the shaft this gouge of slate and quartz occupies what may be a spur in the footwall of the main Bunker Hill or hanging-wall vein, the junction of the two being 860 ft. north of the shaft. The large 'grey ore' body occupied the wedge between them. The hanging-wall vein showed a length of 800 ft. and an average width of 5 to 6 ft. of material where opened on the 2400 ft. level, but the assays generally on this vein between the 800-ft. and 2800-ft. levels were too low to make ore, and much of it was left unstoped.

### Ore and Concentrate

About two-thirds of the gold saved from ore and "near ore" mined in later years, was from concentrate. Over a period of several years the concentrate averaged 3.14% of ore and yielded an average of $77 a ton. The recovery was 80% to 82% before a ball mill was added to regrind sand tailing. This was used only about 2 years. For some years a cyanide plant was operated on tailing, but the saving with this went as low as 25 cents a ton.

Mining and Milling

On the Bunker Hill vein square-set timbering was used with filling. Timbering cost 30 cents a ton. On the 'grey ore bodies' the shrinkage system of mining was followed, using some stulls and butt caps. The average production of ore per man-shift for underground workers was 1½ tons and for the entire crew about 1¼ tons during years of full operation. The total operating cost then was $3.34 a ton, of which $1.66 was for mining, 25 cents for treatment and 45 cents for development.

There was a 150-gallon electrically driven pump on the 800-ft. level, one of 50 gallons capacity on the 2100-ft. level and an air driven pump on the 2400-ft. level. About 50 skips of water a week was hoisted from the bottom of the shaft (2800 ft.) and about 10 skips a day from the winze (3440 ft.).

Ore was hoisted in 2½-ton skips by a double-drum hoist with 300-h.p. motor. The reduction plant had a simple flow sheet, equipment having been as follows: Knight crusher, forty 1050-lb. stamps, 24 vanners, 5 other concentrators, and 5 ft. by 6 ft. Hendy ball mill. Milling practice when at full capacity in 1915–1916 included stamping and amalgamation, followed by concentration on Deister tables after which the sands were ground in the Hendy mill and the entire pulp was concentrated on the Frue vanners.

*Centennial* claim is in W½ of SW¼ Sec. 13, T. 7 N., R. 10 E., a little east of the Dry Creek claim of Detert Group. The vein is in the altered greenstone of the hanging wall of the Mother Lode. An inclined shaft was sunk in 1900 to a depth of 630 ft. It passed into the footwall and crosscuts were run to the vein on the 150-, 250-, 350- and 630-ft. levels. Width of the vein is reported from 2 to 18 ft. There is no record of production.

*Central Eureka Mine*

History and Production

Originally located as the Summit Mine in 1855, the claim yielded a 'chimney' of ore at a depth of 165 ft. which produced $30,000. Two shafts were carried down to depths of 550 and 700 ft. respectively, without any more production, and work had been stopped by 1875.

The mine lay idle thereafter until 1896 when Central Eureka Mining Company began operations. The later history has been highly interesting. The south shaft, which was 700 ft. deep when this company started, was sunk to a depth of 2500 ft. by 1907. A 10-stamp mill was built in May, 1900, but production had started before this, some ore having been crushed at the Zeila mill. During this period, ended in 1907, the operations were on the hanging-wall vein between 1000-ft. and 2500-ft. levels, but a little ore was taken from the intermediate vein. Very good profit was realized from this section of the mine, but the best ore had been mined by 1907.

After closing down in that year, the mine was reopened in July, 1908, but for the next ten years results were discouraging. The extraction dropped to an average below $4 a ton and many assessments were levied. The retiring directors in April, 1916, concluded the mine was exhausted, and wanted to quit. Conditions at the time appeared to

warrant this. The shaft had been sunk an additional 1000 ft. and for several years the ore-shoots had been shortening and of low grade. The plant was getting old and the shaft was in dangerous condition, with the skip still being run on strap iron. Due to the convergence of the end-lines in the direction of the dip, the length of the holdings along the contact vein was shortening on each successive level. All 3 veins had been mined and had proved disappointing. But although the 48th assessment had been levied, it was fortunate for all concerned that the new directors determined to continue.

Early in 1919, the 3500-ft. level was reached. The shaft crosscut on this level showed signs of ore. On the north, also, a good shoot was found and was stoped to the 3425-ft. level. In a winze below the 3500-ft. level a sub-level was turned and was run both ways in fine ore. Then followed a period of 11 fortunate years during which the shaft was carried to a depth of 4965 ft. on the incline and every year witnessed the payment of dividends. During this period the adjoining Old Eureka mine comprising the Amador, Maxwell, Alpha and Railroad claims and 136 acres of adjoining land was bought and paid for; a new steel head-frame was erected and many other replacements and improvements were made.

Below the 4500-ft. level the ground was found to be badly broken, and shaft and drift maintenance and other underground repairs cost more than breaking ore. These conditions, together with a lowering of gold content in the ore, led to a substantial operating loss during the calendar year of 1930. The lower workings of the Central Eureka were therefore abandoned and all pipe, rails, pumps, etc., were removed from the deeper levels and the track in the shaft below the 3900-ft. was taken up. This closed, at least for the time being, the productive history of the Central Eureka or Summit claim. Since then attention has been turned to the development of the Old Eureka section, separately described under that name.

The production of the Central Eureka claim has been about as follows, including the year 1930:

| | | |
|---|---|---|
| From 1869–1871 | $30,000 | (ore $16 to $32 a ton) |
| From 1896–April, 1901 | 223,470 | (tonnage not known) |
| April, 1901–1907 | 1,945,000 | from 287,175 tons |
| July, 1908–April, 1918 | 923,455 | from 269,056 tons |
| April, 1918–end of 1930 | 5,200,000 | from @ 607,000 tons |
| Total | $8,321,925 | |

Dividends paid up to April 25, 1929, amounted to $3.21 a share or a total of $1,263,973. Total assessments levied up to 1929 amounted to $500,000.

Since 1930, the production has been coming from the Old Eureka section of the property.

### Mine Workings

The Central Eureka shaft is 4965 ft. long on an average dip of 70°. It struck the hanging-wall or east vein at 500 ft. and followed it to about 2000 ft. in depth, where it passed into the slate in the footwall of that vein. It cut the intermediate vein below 2700 ft. and

25 ft. below the 3425-ft. level entered the altered andesite, but below 4000 ft. again entered the slate. The footwall is black Mariposa slate nearly all the way. This shaft, like many other old ones on the Mother Lode which were sunk to follow the vein, has been expensive to keep open. The swelling footwall shoves shaft timbers out of line. Below the 4500-ft. level, especially difficult conditions were found, with fractured and moving ground. From the 4500-ft. level down, the shaft sets are of spruce logs 2 ft. in diameter with jacket sets behind them. These jacketed sets were tightly lagged to keep the ground from running. The shaft has three compartments each 3 ft. 9 in. by 5 ft. in the clear. Two are skipways and one a manway. Skips of 3 tons capacity operate on 52-lb. rails laid 27 inches apart on the footwall plates of the shaft. The hoist in use was first installed at the Gwin Mine in Calaveras County in 1900 and was brought to the Central Eureka in 1920 and rebuilt. It is operated by a 300-h.p. motor.

Headframe, Central Eureka Mine, showing skip runway in the form of a bridge truss.

*Photo by C. A. Logan.*

Central Eureka shaft has been abandoned below the 3350-ft. level. If experience with the nearby Old Eureka shaft is any guide it will be only a matter of time when the lower part of the abandoned section and the lower levels collapse because of heavy ground pressure, if this has not already occurred. Levels were turned at intervals of about 100 ft. to 200 ft. depending on conditions. The deepest level was at 4855 ft. (on 70° incline). From 1919 to 1930 the mine was deepened from 3500 ft. to the bottom with levels at 3500, 3600, 3760, 3900, 4100, 4250, 4400, 4550, 4700 and 4855 ft. During this

time the South Eureka ground was under option and was prospected on the 3350-, 3900- and 4100-ft. levels. The 3900-ft. level was run south 1180 ft. from the shaft, extending some distance into the South Eureka, and a crosscut was run 740 ft. east in the slate from this level through several vein formations and gouge seams, without finding ore. The 4100-ft. level was also extended into South Eureka ground. Due to shortening of the Central Eureka claim on the contact vein with increasing depth, an account of the converging end-lines, the purchase of the Old Eureka was important. The 4450-ft level was the most important in the mine, but on this level and on the 4400-ft. on the south end of the mine the ground became badly broken and had much gouge. Very heavy timbering was required in drifts as well as in the shaft. Booms and lagging had to be used in places. On the 4855-ft. level a crosscut was run 240 ft. east and this struck a large body of 'gray ore' on which considerable prospecting was done, besides which the footwall drift was carried north 800 ft.

Geology and Ore Shoots

The Mother Lode belt at the Central Eureka is about 1600 ft. wide and composed mostly of Mariposa (Jurassic) black clay slate, in which occur in the westerly or footwall section, several beds of andesite or andesite porphyry. It is in that section that ore so far has been found. This series of rocks dips east at a steeper angle than elsewhere on the lode. The principal vein worked in the earlier operations was the so-called hanging-wall or east vein, which had an andesite bed for its immediate hanging wall. The ore shoot on this vein extended from near the 1000-ft. level to 2540-ft. level, was from one to 12 ft. thick and had its greatest stope length about the 1500-ft. level. The exact tonnage from this shoot is unknown but was probably about 300,000 tons which was worked with results noted (*ante*) between 1896 and 1907, averaging $7.16 a ton up to 1905.

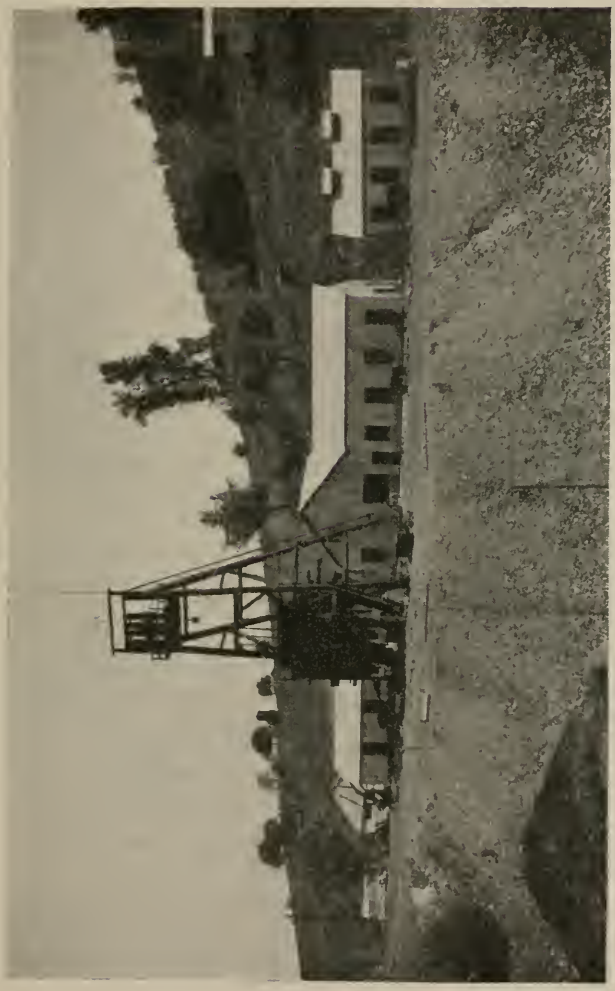
Between the 2540-ft. and 3425-ft. levels, the mine showed most of those aspects which conservative engineers use as criteria of a worked out property. The most of rock milled did not pay expenses, and if ore were encountered it soon gave out. Contact, footwall and intermediate veins were all explored and mined with similar discouraging results. The average yield between 1908 and 1919 was only $3 to $4 a ton. The size of bodies of even this grade kept decreasing. The east vein was mined down to the 3350-ft. level with unsatisfactory results. The intermediate vein also fell off in grade and the stope length shortened below 3000 ft. A crosscut was run 774 ft. east on the 700-ft. level without finding ore; and on the 1800-ft. level, a footwall crosscut 717 ft. long gave no encouragement.

The first indication of better times was the occurrence of small lenses of good ore in the footwall gouge on the 3350-ft. level. Good ore two ft. wide was found on the 3425-ft. level. On the 3500-ft. level in 1919 a contact between slate and 'greenstone' (altered andesite) was struck 28 ft. southwest of the shaft. This contact was followed 215 ft. south by drifting and revealed from 2 ft. to 5 ft. of rock and ore assaying $2 to $7 a ton. A crosscut run 30 ft. west from this drift revealed 3 ft. of fine ore. The main crosscut westward from the shaft was in crushed slate and quartz stringers. In this crosscut,

33 ft. west of the greenstone contact, quartz was cut on the north side and on being followed it proved to be a good ore-shoot. From this north drift, a crosscut northeast to the 'greenstone' contact failed to show ore; but 30 ft. farther north, another hanging-wall crosscut struck a small ore-shoot. In the floor of this north drift on the 3500-ft. level, a winze was started and at a depth of 85 ft. drifts were turned. The first 50 ft. on the north had an average width of 14 ft. and assayed $20 a ton; for 80 ft. on the south it was even better. This ore was ribbon rock carrying a good deal of pyrophyllite. Thus what appeared to be two ore-shoots, separated by 160 ft. of low-grade vein filling, were found. In depth, however, the south shoot pitched north and they joined at the 3760-ft. level. On the 3760-ft. and 3900-ft. levels this footwall ore-shoot (which is difficult to correlate with previous ore bodies because of inaccessible workings, but is not believed by Albion S. Howe to be in the same vein mined above the 2540-ft. level) was 340 ft. long and averaged 9 ft. to 10 ft. wide, consisting of ribbon rock and gouge on both walls.

The most important and productive level in the mine was at 4550 ft. inclined depth on this ore-shoot. The shaft crosscut (running northwest) crosses a width of 60 ft. on that level that should probably be considered vein matter. North of this, the main vein (footwall vein so-called) was a stringer lead of crushed quartz and slate striking N. 40° W. and dipping 71° E., and the orebody had an average pitch of 45° NW. in the plane of the vein. On the east side, a spur vein striking N. 25° W. makes into the vein at this ore-shoot. This spur vein itself formed stoping ground for a length of 165 ft. from its junction with the main ore vein, which it entered about the center of the main ore shoot, here having a length of 425 ft. In cross section, west to east, the writer observed the following sequence in the stope above the drift: high-grade quartz ore in black graphitic schist, perhaps a phase of an altered dike; next, 8 ft. of quartz ore, on the hanging wall of which appeared the point of a 'greenstone' dike, 18 inches wide, separated from the ore by a small slaty gouge. This had on the east more of the graphitic schist. Here we have a fine example of the occurrence of an important orebody at a junction. Here the ore vein (footwall vein) and the contact vein meet or are linked by veins like this spur. Schistose altered greenstone appears close by in the footwall, and on the hanging wall are layers of slate interbedded with greenstone dikes or sills. A very rich streak of high-grade quartz, so finely crushed that it could be rubbed to powder in the fingers, traversed the spur vein diagonally to its junction with the main shoot. On the north and separated from the main ore body by 130 ft. of low grade, a quartz orebody 80 to 100 ft. long was found. This level yielded over 100,000 tons of ore, carrying $10 to $14 a ton. A width of 25 ft. was stoped in places.

The broken, heavy and moving ground encountered first in the south workings about 4400 ft. deep, passed downward through the 4700 ft. level station and the bins there were in it. It faulted the orebody farther north with greater depth. The increasing cost of work when this cross fault entered the ore zone already crushed by subsidence or tension fissuring from the hanging wall, and the lower grade of ore, ended profits from this shoot on the 4855-ft. level. This vein gave out on this level 800 ft. north of the shaft, according to Albion S. Howe.



Headframe, Old Eureka Mine, Sutter Creek.

*Photo by courtesy of Central Eureka Mining Company.*

Crosscuts were run to the hanging wall 'greenstone' on the 4855-ft. level and one that penetrated it showed it to be crushed and badly shattered. Next to the slate hanging wall this greenstone is well mineralized, and carries bunches and stringers of quartz. On the north end of this level, 600 ft. to 700 ft. north of the shaft the 'gray ore' formed in this greenstone is reported by James Spiers, superintendent, to be 60 ft. wide. While it was prospected only at intervals, there were indications of a large body of it which gave great variations in assay returns. This body appeared to have its apex along the 4700-ft. level and a little above it.

Milling, and Ore Characteristics

The 40-stamp mill has a capacity varying from 146 to 160 tons in 24 hours, depending on the condition of feed. The stamps weigh 1280 lbs. each fully shod, drop 96 times a minute and crush ore through 24-mesh screen. Concentrate is saved on Frue vanners. Recovery has varied from 89.37% to 94.31% of mill-heads since 1920. The latter figure was obtained when mill heads averaged $13.148 a ton for a year, and was probably due to the greater proportion of coarse free gold, as compared to gold in sulphides. This proportion has varied considerably from year to year, having been nearly 6 to 1 from 1920 to 1925, 4 to 1 in 1926 and less than 3 to 1 in 1930. Crushed ore, unavoidably diluted by gouge and wall rock, lowered ore grades, and also recovery due to loss of fine sulphides. The percentage and value of concentrate ranged from 1.69% worth $107 a ton on the 3700-ft. level, to 2.8% worth $68 a ton at the 4700-ft. level. Tailing has varied in value from 64 cents to $1.12 a ton.

Information Circular 6512 of the U. S. Bureau of Mines, written in 1931 by James Spiers, superintendent of the mine, gives an excellent account of mining methods and costs at this mine.

*Chicago, Conville, Giant* and *Reeves (Bartlett, Accident, A & B)* claims are on the hanging wall side of the wide Mariposa slate belt a little southeast of Plymouth. There is little available concerning the results of work on them. The *Chicago* claim has a shaft reported to be 400 ft. or more in depth. Some of these claims have been pocket producers. The principal vein on the contact, with slate footwall and amphibolite hanging wall, does not appear to have been productive.

*A & B* claim had a shaft 175 ft. deep, two crosscut adits and an open cut 200 ft. long, run in search of pockets.

*Creek Ledge* prospect, a mile north of Plymouth on an agricultural patent, has a shaft 100 ft. deep sunk on the vein between the slate footwall and greenstone hanging wall. Vein varies from 4 ft. to 10 ft. wide. Only about 50 ft. of drifting was done on the 100 ft. level. No work has been done for over 20 years.

*Detert Estate Group* comprises 17 quartz claims in Secs. 11, 13, 14, 23 and 24, T. 7 N., R. 10 E., between Plymouth and Amador City, belonging in whole or in part to the estate of the late W. F. Detert. These claims, on which no work has been done in late years, were gradually accumulated over a long period by the late owner, who has left no record of the past operations, and apparently the only information concerning them is that appearing in past State Mining Bureau

reports and the notes gathered for the present paper. Names of the claims and acreages are:

Atlantic Q. M., 15.46 acres. California Q. M., 10.81 acres. Chili Jim Q. M., 4.56 acres (⅔ interest). Cosmopolitan Q. M., 15.90 acres. Dry Creek Q. M., 5.5 acres. Eureka No. 2 Q. M. @ 10 acres. Governor Bradford Q. M., 12.091 acres (⅓ interest). Henry Clay Q. M., 6.49 acres. Hercules Q. M., 15.59 acres. Joe Davis Q. M., 8.27 acres. New London Q. M., @ 18 acres (⅓ interest). North California (Webster) Q. M., 6.99 acres. North Eureka No. 2 Q. M., @ 5 acres. North Henry Clay Q. M., 11.89 acres. Pocahontas Q. M., 10.25 acres (⅔ interest). Providence Q. M., 16.33 acres. South Cosmopolitan (Worley) Q. M., 14.29 acres.

The *California*, also called the *Potosi,* was the earliest of these mentioned. In 1867 it was said to have been worked since 1852 and had a vein 4 ft. wide. It was equipped with a 16-stamp mill. In 1876 it was idle, the shaft having reached a depth of 200 ft. It is reported locally that this claim produced $82,000 near the surface, but there is no definite record to substantiate this. In 1880, a new company repaired the mill, and the claim was said to have good ore. In 1884, nine miners took the mine "on a lay" under which they were to be paid wages if the company took the property back within a certain time. They made three 'crushings' of ore which averaged according to report $3.50 a ton. This came from an adit.

The *California* was also partly prospected from the Pocahontas shaft which was sunk vertically on the latter claim near the common side-line (See Pocahontas).

*Cosmopolitan Group,* before its purchase by Detert, included the Cosmopolitan, Dry Creek, South Cosmopolitan, Henry Clay, Providence, and 142 acres of agricultural land. Between 1850 and 1890 considerable work was done on these claims. Cosmopolitan shaft was sunk 750 ft. on 67° incline with levels about 100 ft. apart from 200 ft. to 700 ft., inclusive. On the 200-ft. level, a drift was run north 185 ft. and on 400-ft. level, south 500 ft. On the 200-ft. level, a crosscut was run 107 ft. in the footwall and one 45 ft. west. Below this level, the greenstone of the hanging wall was reached only on the 400-ft. level. The vein is reported to have had an average width of 5 ft. with a slate footwall. The shaft was sunk in a faulted or crushed zone and struck the slate at about the 200-ft. level. Most of the work is said to have been done in this disturbed area. There was a stamp mill on the claims in the 1890's, but there is no record of production, though some mill tests were made.

*Henry Clay* claim has an old shaft 200 ft. deep, in which it is reported a vein 6 ft. wide was cut, with 4 ft. of gouge.

*South Cosmopolitan* claim has an adit 200 ft. long.

*Pocahontas* claim was prospected by a vertical shaft 620 ft. deep with levels at 74, 145, 310, 400 and 585 ft. in depth. This shaft was near the California claim's side line and the latter claim was partly prospected by the longer crosscuts, of which the following were run:

On 74-ft. level, west 178 ft.

On 145-ft. level, west 330 ft. to footwall vein, and east 120 ft.

On 310-ft. level, 561 ft. east cutting hanging-wall vein 150 ft. east of shaft.

On 400-ft. level, 200 ft. east.

On 585-ft. level, a drift was run south on the vein 230 ft. from a point 252 ft. west of the shaft.

In 1898, a 10-stamp mill was erected and the first bullion was shipped in February, 1899. There was also a small production in 1900, after which year there is no further record of activity.

So far as can be learned, most of the work done on these claims showed broken or disturbed conditions. Details of geological conditions underground are lacking, although current claims made during the progress of work indicated some good assays. In the work done through the Pocahontas shaft the country was explored from the massive diabase hanging wall to the Mariposa slate footwall.

*El Dorado* (*Mayon*) claim is on a narrow lens of slate lying in the hanging-wall greenstone immediately east of the Keystone claims, this slate being the north extension of the east belt of slate separated from the main slate by a large interlayered mass of greenstone, as mentioned under the Lincoln.

This claim was prospected by a shaft 300 ft. deep, on 45° incline with levels 100 ft. apart, and a length of 400 ft. was drifted. Vein is reported to have an average width of 5 ft. There is no record of production.

*Fremont and Gover Mines* cover 4200 feet along the strike of the Mother Lode, including Fremont, Gover, Loyal Lode Mine and mill site, North Gover, Bona Esperanza Quartz Mine and mill site, one-half interest in Bona Fortuna Quartz Mine and mill site and several parcels of non-mineral land.

History and Production

The Loyal Lode had a 20-stamp mill before 1867 and at an earlier date the quartz on the surface had been worked in arrastres; but by 1876 a depth of only 100 ft. had been reached and the claim was idle. Work was resumed in the 1880's and in 1886 it was producing ore that yielded $7 to $8 a ton in free gold. In 1888, two ore-shoots were reported, one 200 ft. and one 80 ft. long between 'diorite' walls. Fourteen men were working and the 10-stamp mill was crushing 15 tons a day. The 200-ft. ore-shoot had been opened its full length and was reported 20 ft. wide. The work was done through 3 adits, the deepest 600 ft. long and 120 ft. deep at the face. There are no later records, and no details of the output.

The Fremont and Gover were consolidated at an early date and the company formed in 1872 worked principally in the Gover claim. The north or principal shaft finally reached an inclined depth of 1500 ft. (1050 ft. vertical). The only figures available indicate an annual output of from $50,000 to $70,000 in the late 1880's and early 1890's, with the last reported production in 1894. In 1888, ore yielded $9 to $13 a ton.

The Fremont shaft was started in 1900 and a new mill was built in 1903, containing forty 1000-lb. stamps and 16 Frue vanners. Fremont Consolidated Mining Company worked to a depth of 2950 ft. on

51° incline. They quit in December, 1918. Late in 1920, Metals Exploration Company began unwatering the property, and prospected it from 1921 to 1923. In the latter year, 20 stamps were put in operation, but work was stopped in August. A new company, Fremont-Gover Mines Company, was incorporated at once by former employees, but they were unable to finance work long, and quit in 1925. Shortly after, Black Hills Fremont Mines Company did a little work in a shallow adit and a winze 100 ft. deep on North Gover claim 600 ft. north of Gover shaft. This venture also was short-lived.

The only public record of the production of these mines previous to 1900 is for the period 1888–1894 during which Gover Improvement Company produced $259,389. Between 1900 and 1925, there was a reported output of about 930,000 tons which is said to have averaged about $4 a ton recovered; in the later years of work by Fremont Consolidated Mines Company the mill-heads averaged between $5 and $6 a ton. There has never been much publicity about the earnings of the property, but in later years at least the margin of profit was small. Dividends are said to have amounted to $316,000. A total of $200,000 stock was issued.

Mine Workings and Geology

The Fremont shaft was 2950 ft. long on an incline of 51°, with levels about 200 ft. apart. Drifting was extensive and aggregated several miles, the vein having been followed for 2500 ft. north from this shaft. The deeper of the Gover shafts, 1500 ft. long on the incline, is 1430 ft. north of Fremont shaft. Most of the work at this property had been done before the owning company quit in 1918. They had hoisting plants at both the above shafts, which were connected. The sinking of Fremont shaft to 2950 ft. was finished in 1918. The geology of the Gover mine and Loyal Lode was covered in Reports VIII, X, XI and XII of the State Mineralogist. As the Fremont is described in detail in U. S. Geological Survey P. P. 157 only a short summary is given here.

The Loyal Lode has already been mentioned. It is a claim over 2000 ft. long on the hanging wall of the main mine, and within the greenstone. In the Gover, two veins were developed which were separated by a reef of black slate, sometimes only a gouge but elsewhere 90 ft. or more wide, and having greenstone as its hanging wall. The contact vein, next to the greenstone, produced the best ore, which often occurred in pockets as stringers extending into the greenstone, and contained arsenopyrite. The other vein was of slate-quartz ore. The contact ore shoot was over 300 ft. long. The slate-quartz shoot (having slate for both walls) was 280 ft. long. On the 500-, 600-, and 700-ft. levels, the veins were 15 ft. to 60 ft. wide. The contact vein pinched at 775 ft. and according to the Twelfth Report of the State Mineralogist it was not until the ninth level was reached that the shaft left the slate-greenstone contact, entering the greenstone. This point of departure (placed at a depth of 600 ft. by Knopf) marked the beginning of the principal 'gray ore' or schist orebodies, associated with the East vein after it passed into the greenstone. Here the low-grade orebody was reported to be 300 ft. long with an average width of 30 ft. The lode was explored for 1100 ft. south and 400 ft. north of the Gover

shaft. At a distance of about 1000 ft. south of Gover shaft on the fourth level, the hanging-wall vein passed into the hanging-wall greenstone. A little south of this, the vein and wall rocks were faulted west.

The 1500-ft. level of the Gover, running south, connected with the 1350-ft. Fremont north drift, both being on the 'gray ore' zone, containing wide bodies of low-grade white quartz and lenses of 'gray ore,' which is hydrothermally altered greenstone containing from 3% to 5% of auriferous sulphide, mostly pyrite, which carried three-fourths to five-sixths of the gold. The largest 'gray ore' body extended down to the 2300-ft. level, had a width up to 70 ft. and was in the angle between the slate-quartz vein and hanging-wall vein. Other lenses of 'gray ore' also were mined between the 800-ft. and 2500-ft. levels, among these being the 19 No. 2 South Shoot, 700 ft. south of shaft, and the 19 North Shoot under the shaft. These varied in width, their wider sections being 10 ft. to 25 ft. thick, with stope lengths up to 160 ft. The average value of mill-heads concealed wide variations. The upper levels of the Fremont shaft had developed the quartz-slate and pocket veins.

The mill operated by the Fremont Consolidated Mining Company handled about 200 tons daily and produced about 200 tons a month of concentrate which was worth $65 to $100 a ton. Concentrate was saved on Frue Vanners, and as mentioned before, carried from three-fourths to five-sixths of the gold. This mill saved 85% of assay value. California Slimes Concentrating Company worked the tailings on royalty, recovering about one-third of remaining gold by regrinding, concentration and cyanidation.

By way of contrast, it may be noted that in the early operations on the slate-quartz ore (Mother Lode vein) in the Gover, the concentrate formed 2% of ore and was worth from $115 to $200 a ton.

Mining was partly done by square setting and partly with stulls, all stopes being filled. Toward the end of the owning company's operations, a total of 140 men were employed.

*Good Hope Mine* is on the west side of Jackson townsite, adjoining the Anita. It was held by one owner 34 years, during which time little was done. In 1896 a 10-stamp mill was built by Good Hope Mining Company and a shaft 130 feet deep on 80° incline was sunk by 1897, with a level at 70 feet from which drifts had been run 136 feet south and 40 feet north. The vein in the shaft is said to show 10 inches or more of auriferous quartz and four or five feet of slate with quartz stringers. In the drifts, the width of ore was reported to be seven feet or more, assaying well enough to pay, had it been in sufficient quantity. A second level was turned at a depth of 115 feet. The claim has been idle a long time, and there is no record of further work, if any was done.

*Hardenberg Mine* was worked through a shaft 500 ft. deep in early days, but details of the results are not available. It was reopened in 1890 and equipped with 10 stamps. In 1892, $23,500 was produced between the 300-ft. and 600-ft. levels, and in 1894, when work had reached the 800-ft. level $12,002 more was taken out. Work stopped in 1895 at a depth of 1000 ft. The last ore milled in 1895 averaged $4.19 a ton.

In April, 1911, the stockholders of the South Eureka Mining Company began reopening and sank a vertical shaft 1100 ft. deep and in

1913 and 1914 reported production of 26,478 tons which yielded $65,970 or $2.49 a ton, principally from the 850-ft. and 1000-ft. levels. In both of the above operations the ground was found to be heavy, badly shattered and with a wide gouge on the black slate footwall. At 800 ft. in the earlier workings the fissure was 15 ft. to 20 ft. wide and filled with slate, gouge and some quartz, and in the later work the heavy hanging wall and the gouge prevented mining clean ore.

In spite of these experiences a third reopening was begun late in 1916. About one year was spent in underground prospecting during which time the shaft was deepened to 1500 ft. and a level turned near the bottom. There is no record of production during that period. In March, 1918, the property was sold for the benefit of creditors and has been idle since. A 20-stamp mill put up for the use of the mine was found to be on ground outside the holdings.

*Italian Claim* is a patent of about two acres between the Seaton (Peerless) and Loyal Lead Claims. As originally located, it contained 302 ft. along the strike. The vein lies between slate footwall and greenstone hanging wall. In the early 1860's it had a 6 stamp mill, and some 2000 tons of quartz from surface workings was crushed. About 1890 work was begun again and a crosscut was open giving a reported depth of 150 feet. From this a small quantity of rock had been crushed in the Seaton mill, with results now unknown. In 1932 the present owners started work through an adit level with its portal about 50 ft. south of the north line of the claim. This enters the footwall side of the wide vein. From it a crosscut was run 125 ft. to the greenstone of the hanging wall. Good assays have been obtained for a width of 10 to 15 ft. near the footwall; also in a short drift started 45 ft. from the footwall in a southeasterly direction. Work was being continued late in 1933 with encouraging results.

*Kennedy Mine* holdings embrace, besides the original Kennedy claim located in 1856, the Bellwether, Clyde, North Clyde, North Clyde Placer, and Silva quartz claims and other land, 156 acres in all. The Zeila Mine, including the Coney and Bigelow, Blue Jacket claims and several agricultural tracts, 260 acres in all now belong to the same owners.

History and Production

Until 1871, the Kennedy was worked in only a small way, with a whim for hoisting. In 1871 the first hoist and a 20-stamp mill were erected. From then until November, 1873, the production was $183,427 from ore of an estimated average yield of $16.67 a ton. In 1873, two ore-shoots were being worked. On the north end, the Kennedy ore shoot was 150 ft. long and 2 to 12 ft. wide and had been worked to 400 ft. in depth. The Pioneer (Argonaut) ore-shoot was on the south end-line and at that time had been opened for a stope length of 170 ft. in the Kennedy. It was 18 ft. wide at the Pioneer line. Only four miners were employed in stoping to produce 20 tons of ore a day, the capacity of the mill. Mining cost $4 a ton and milling $2.46 a ton. The mine produced $300,000 to a depth of 600 ft. up to the latter part of 1874. Soon after, the workings must have struck a lean zone as ore is said to have given out in the south shaft, with the raking of the

ore shoot into the Pioneer claim. No ore was milled in 1875, when the deeper shaft was down 850 ft.

Evidently little was done thereafter until late in 1885, when the present owners, Kennedy Mining and Milling Company, took the mine. Unwatering began in January, 1886, and by October of that year a new 40-stamp mill with 16 Frue vanners had been erected, and 32 stamps were in operation. In an article published locally in July, 1886, it was stated there were large bodies of ore in the mine, "that could not be made pay under the expensive method of working 15 years ago." It was also stated that an examination of the books "shows that the last 2000 tons of ore crushed yielded an average of over $6 a ton in

Headframe, Kennedy Mine.

*Photo by Walter W. Bradley.*

free gold. As the property was then fixed, running mill and mine by steam, and using 12 or 13 cords of wood per day, and crushing with 20 stamps of 400 lb. each not more than 20 tons per day, it cost about $16 per ton to mine and mill the rock, representing a loss of $10 on every ton crushed."

The new mill and hoist were designed to run by water power, and it was believed a profit could be made on the ore. The shaft was a little over 900 ft. deep, but the 900-ft. level had not yet been turned.

That the expectations of the company were realized, was shown by a statement published early in 1897, that in the past ten years the Kennedy had produced $3,580,000, of which $2,000,000 was claimed to have been paid in dividends. Approximately 36,000 tons of ore is

said to have been milled annually during this time (the mill having been erected under a guarantee to crush 100 tons a day). An interesting sidelight was thrown on the grade of some of the ore mined during this period by evidence in two suits of Argonaut Mining Company versus Kennedy Mining and Milling Company, the first started August 11, 1894, and the second August 5, 1897, with a decision dated March 13, 1899. Testimony was given that 2604 tons of ore mined from ground south of the Kennedy south line on the 1450-, 1550-, 1650- and 1750-ft. levels had yielded $62,218.45 or $23.89 a ton. A cost of $6,119.40 or $2.35 a ton was allowed for mining and milling this.

The company has maintained a policy of secrecy and few authentic data have been published in 30 years about the results of mining. Storms in 1900 estimated the total cost (not including depreciation and depletion) to be $4.50 to $5 a ton. Work had then reached a vertical depth of 2300 ft. About that year the new vertical shaft was started 1950 ft. east of the north shaft. This eventually struck the two veins and has been the main working entry since 1904. In that year, a new 60-stamp mill was in full operation at this (east) shaft, as well as the old mill of 40 stamps at the north shaft. Ore was coming from levels between 1800 and 2550 ft. deep and 250 men were employed. From then on the mine was the deepest and largest producer on the Mother Lode for many years until the Argonaut began to vie with it. The larger mill was increased to 100 stamps and for 12 years up to 1916, from 140,000 to about 170,000 tons of ore was crushed annually. This was taken mainly from the section between 2250 and 3450 ft. deep. The veins ranged from 5 to 30 ft. wide, the usual width being from 5 to 12 ft. Sometimes high-grade quartz was struck, but yearly average mill returns were reported to be $4 to $5 a ton.

With increasing depth (4050 ft. vertically in 1920 and over 5000 ft. by 1932) and increasing cost, it has in late years been necessary to mine more selectively, with a resultant decrease in tonnage milled, and an increase in gold content of ore to one-third or two-fifths of an ounce per ton. The workings have reached a depth of about a mile vertically. Since the last report (in 1927) the mine suffered a disastrous surface fire September 7, 1928, which destroyed all surface plant except the mill and main office, and resulted in damage underground. The plant was replaced and work in the mine resumed by the middle of 1929. In 1931 as a result of successful experiments, the flotation process was installed to handle plate tailing. Since 1929 work has been done in the lowest levels through a 65° 3-compartment inclined winze sunk from the 4650-ft. level with the last level at 5250 ft. This last level has not so far proved as productive as might be wished, and output has been curtailed lately.

Figures given in a report by Waldemar Lindgren (Mineral Deposits, 1919) for the production of the Kennedy Mine to the close of 1915, and quoted by the present writer in a previous report appear to be erroneous. The mine had produced over $14,500,000 up to that time, and its total output to the close of 1933 has been approximately $25,000,000. As the stock has been closely held, the amounts of dividends and assessments have never been published. Dividends of about $5,000,000 have been reported from reliable sources. Between 1918 and 1924 due to the expense and loss of time incident to unwatering

the mine after the Argonaut fire, the operations are alleged to have resulted in heavy assessments. Thereafter, some profit was possible for several years. The company was started with a capitalization of only $100,000 which was never increased.

Recently, a cyanide plant has been built to treat the large accumulation of tailings.

Geology and Mine Workings

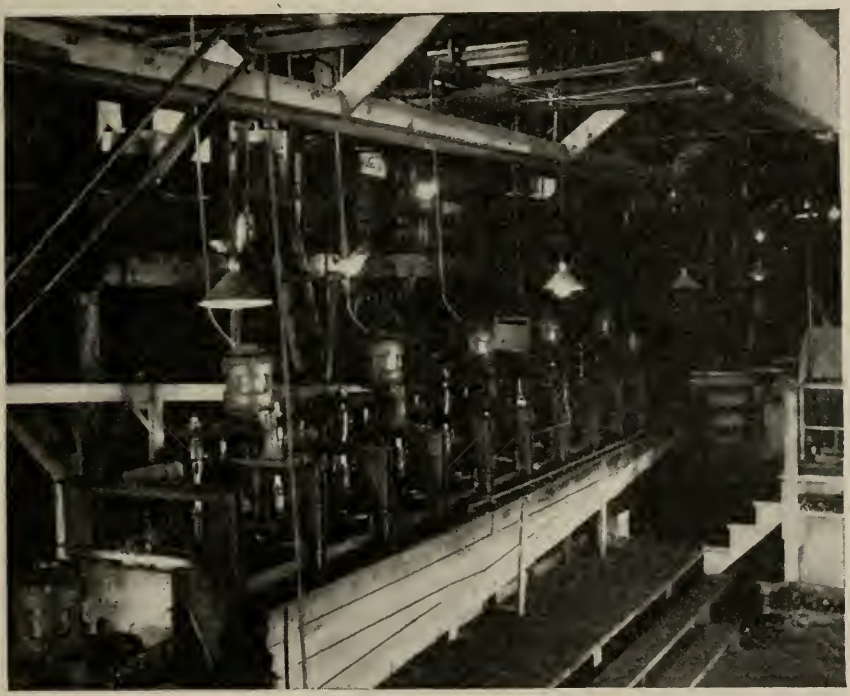
The Twelfth Report of the State Mineralogist (1894), gives a good account of the geologic conditions found to an inclined depth of 2000 ft. A cross-section at the south shaft, beginning with the footwall greenstone and going east, shows: Vein 4 ft. wide, black slate 80 ft.; greenstone 200 ft.; black slate 250 ft.; greenstone 30 ft.; black slate 35 ft.; greenstone 300 ft. and so on, slate and interlayered bands of greenstone alternating. The slate and greenstone were contemporaneous in the narrow bands and the gradation from one to the other so gradual as to make a classification arbitrary. The quartz of the vein continued in the west greenstone-slate contact to a depth of about 300 ft. near the north shaft and 750 ft. at south shaft. Below this, in crossing the slate, the fissure is said to have shown only crushed and foliated black slate, with quartz in small seams and broken fragments. It struck the contact of the next easterly band of greenstone and began to make quartz again at 950 ft. near the south shaft and at the 1450-ft. level opposite the north shaft, forming from these depths another ore zone to about 2000 ft. in depth where another strip of slate was encountered, with poor returns in it.

The Kennedy vein continued in this manner, crossing the various layers, as its eastward dip is at a smaller angle than that of the rock layers through which it passes. Due to the breaking away of an immense 'horse' or lens of country rock from the hanging wall an east vein was formed, starting between 1700 and 2200 ft. in depth and separated from the west or footwall vein by a maximum thickness of about 150 ft. of the 'horse.' Both north of the deep vertical shaft on the 3900-ft. level and south of it on the 4300-ft. level, these veins began to merge, and in the adjoining Argonaut workings on the south there is only one main or footwall vein through this entire depth. Another important factor was the irregular downward course of the Pioneer (Argonaut) north orebody which occurred near the end-line separating the two mines. In places it was partly in each mine; elsewhere, it raked north or south far enough to carry it entirely into one property, as between the 3600-ft. and 4200-ft. levels of the Argonaut, where its north pitch carried it into the Kennedy; below there it returned to the Argonaut, furnishing a large tonnage of ore in the deeper levels of that mine.

The veins swelled abruptly into lenses which furnished ore. Both branches furnished orebodies near and at their north junction to form the main vein but the footwall vein was more important. In later years a length of from 1400 to 1600 ft. along the strike was explored on some levels. In the middle levels, now closed, the ore was reported in lenses over a length of 800 ft.; with from 7 to 11 ft. of ore on one vein and 6 ft. on the other, the lenses of ore lying en echelon. On the 3900-ft. level, where the two veins joined 140 ft. north of the shaft, a

large orebody was formed and was followed northward several hundred feet. On the 4350-ft level south of the shaft they were separated by 33 ft. of filling, and on the 4500-ft. level they were separated by only a few feet of slate. Here the footwall ore body lengthened to 700 ft. and gave fine assays. The grade of ore had begun to improve in 1924 and probably more selective mining from then on had improved mill heads. Ore from the 4350-ft. level in 1926 averaged $10 a ton and since that time the average grade of mill heads has continued higher than previously.

The average thickness of ore mined has ranged from 8 to 15 ft. In places 30 to 40 ft. in thickness was worked and Knopf mentions a



Kraut 6-cell flotation unit in mill of Kennedy Mine, Jackson, Amador County.

*Photo by Walter W. Bradley.*

maximum stope width of 112 ft. The lenses of ore pinch and swell abruptly both on the strike and dip. The superintendent distinguished the ore from the hanging-wall vein as more slaty and with more sulphide than that in the footwall vein which showed more free gold and pyrophyllite (hydrous silicate of aluminum) possibly the same mineral called by Knopf damourite (hydrous silicate of aluminum and potassium). Generally the best ore was the banded or ribbon rock, of hard white quartz with numerous ribbons of finely ground slate and often ribbons of fine-grained pyrite and galena, showing building up of the vein by repeated opening. Where coarse free gold occurred it was generally associated with the light green pyrophyllite (?).

Carlton D. Hulin in 1930[1] published the results of a study of some specimens of high-grade ore mined in 1925 from the 3900-ft. level. He found the principal gangue mineral in these was fluor-apatite. The minerals which he classified in the specimens and the order in which he decided they had been deposited were: quartz, apatite, strengite, pyrite, sphalerite, sericite, carbonates, galena, chalcopyrite and gold. He concluded the apatite was here the common host for gold because apatite has well-developed cleavages and tends to fracture easily, and quartz was the least favorable of these minerals for gold deposition because it lacks cleavage and is tougher than the others. Galena and chalcopyrite were favorable, and often showed gold.

The recovery of concentrate in late years (up to the time the flotation plant was installed) was less than 1% of ore milled. The flotation tests (described under Metallurgy herein) emphasized that the ores from different parts of the mine varied and that the apparently low sulphide content was due at least in part to ore not being crushed fine enough to release all gold and sulphide. The concentrate has been high grade for a Mother Lode mine, carrying six to seven ounces of gold a ton, which might indicate loss due partly to table adjustment in the effort to make a very clean product.

In late years milling was done with 100 stamps and later with 60, followed by 40 Frue vanners for rough concentrate and two Frues for cleaning concentrate, with tailing from these last two vanners returned to the stamps. Up to about 1915 or later a canvas plant was used to treat tailing, with Gates concentrators and bumping tables; a chlorination plant was also in use many years. The stamps crushed 4½ to 5 tons each daily through 24-mesh screen and though definite figures are not available, recovery was probably 83% to 90%. Tucker gave the lower figure in 1914

The vertical shaft, started about 1900 at a distance of 1950 ft. east of the vein and old north shaft, has been the main working entry. It has three compartments each 4 ft. by 5 ft. in the clear. It cut the east vein at a depth of 3680 ft.; and west vein at about 4000 ft. It is 4764 ft. deep, being the deepest vertical shaft in the State, and has vindicated the judgment of the operators, giving very little trouble. Hoisting in this shaft was done by steam, using oil for fuel from 1906 to 1926. A total of 1800 h.p. was available but normally 1200 h.p. was used, with a maximum hoisting speed of 2200 ft. per minute with 4-ton skips. In 1927, electricity was substituted for steam, using 800 h.p. and reducing the hosting speed to 1500 ft. per minute. A new surface plant except mill and office had to be installed after the 1928 fire, including a new steel head-frame. Three compressors at this shaft are each operated by a 225-h.p. motor.

The recent work underground has been through a 3-compartment inclined winze sunk on an angle of 65° from the 4650-ft. level 200 ft. from the vein. The deepest level late in 1933 was at 5250 ft. Mining has been done with square-set timbering, filling with waste from crosscuts and chambers.

About 80,000 gallons of water daily has been hoisted with 1100-gallon water skips from the sump and from tanks on the 500-, 1000-

[1]Economic Geology. Vol. XXV, No. 4, June, 1930.

and 1900-ft. levels. Though generally dry in the lower levels, a pocket of water may occasionally be struck in watercourses on either wall.

Tailing has been stored for 20 years behind a concrete multiple-arch dam 455 ft. long by 43.8 ft high as originally built, but planned to be raised to 50 ft. To reach this about 2000 ft. of flume was built and 4 tailing-elevator wheels were used. These are 68 ft. in diameter, with 176 buckets each and each was run by a 15 h.p. motor. In 1933, a new earth-fill dam was built.

Keystone Mines Corporation now owns the *Keystone, Spring Hill, Geneva, Niagara* and *East Keystone* comprising the Keystone group; and *Medean, Talisman* and *South Spring Hill,* formerly called South Spring Hill Mine. These claims cover over a mile in length on the Mother Lode at and near Amador City, and contain 280 acres.

History and Production

*Spring Hill Mine* was the second group of quartz locations made on the Mother Lode in the county, and was locally called the Ministers' Mine, from its locators, who were preachers. It failed to realize the extravagant hopes of its finders. They lost it in 1854, and the new owners in 1855 produced 2221 tons of ore which yielded $21 a ton at an operating cost of $10.50 a ton. Although the shaft was 350 ft. deep and 50,000 tons of ore had been crushed in the 30-stamp mill by 1867, it was said it had paid little, if anything, above expenses. The *Talisman* (*Herbertville*) claim likewise, with a 600-ft. shaft and a 30-stamp mill before 1860, had not done so well. It remained a separate mine until the late 1890's and between 1890 and 1892 produced $48,316. The *Medean* claim also was listed as a separate producer in 1894 and 1895, with an output of $26,600.

*South Spring Hill Mine,* like all those in the holdings, was located in 1851, but apparently did not become an important producer until the late 1880's. In 1887 it had been opened to a depth of 800 ft. and the 30-stamp mill was crushing 70 tons of ore daily. From 1888 to 1902, inclusive, a production of $1,092,472 was reported. There are no figures of tonnage available, but the ore was stated in 1887 to vary in gold content from $3 to $40 a ton and in width from 1 ft. to 50 ft. This is one of the mines about which very little has ever been published, and over 30 years have elapsed since the last work was done. In 1897, previous to which year most of the production was made, it was locally reported that about $250,000 had been paid in dividends. The South Spring Hill shaft was sunk 1200 ft. on 60° incline with 11 levels 100 ft. apart, and over 14,000 ft. of drifts were run.

Talisman and South Spring Hill shafts are about 2300 ft. apart and connected underground. Both have the Mariposa slates on the west and greenstone on the east. The principal ore shoot is reported to have had a stope length of 500 ft. and an average width of 5 ft. The South Spring Hill group became important to its neighbor, the Keystone, when it was found the Keystone orebodies were trending in depth toward the South Spring Hill. This was given as one of the reasons for closing the Keystone in 1920. Thereafter, the group was sold to the Keystone.

*Keystone Mine* grew up about the mining locations of the Granite State and Pleasant Ridge Companies, themselves formed from several claims located in 1851. The Granite State claims were the third group of locations made on that section of the lode, and there were six original locators forming the company, each claim being 60 ft. wide by 120 ft. long. One claim showed particularly rich outcrops, and four arrastres were built to crush selected ore which paid $100 a ton for a few months. A one-half interest was then given in the claims for a 12-stamp mill, but within two years the project failed, and the claims were purchased at sheriff's sale by A. H. Rose of the Pleasant Ridge Company and the Keystone Mine thus came into existence in 1853.

In 1854 a total crew of 18 men produced 2204 tons of ore which yielded $21 a ton, or a gross of $46,284. The total operating cost was nearly $15 a ton, and monthly dividends of $200 a share were declared. By 1867, a total of 44,000 tons had been worked, giving an average yield of $16 a ton or $700,000 in all. The mine had been sold to Gashwiler and McDonald for $102,000 and like so many other of the California gold mines remained practically a one-man or family affair for many years, with only a partial record of results of operation published. Some of these were:

From December 8, 1865, to December 21, 1866, production $135,333.30, dividends $51,300. Average recovery, $16 a ton.

For the year ended July 31, 1868, production $154,354.87 from about 12,000 tons of ore, average yield $12.86 a ton; dividends $75,000.

For the fiscal year of 1870, estimated $25,000 gross and $15,000 net production monthly.

For the fiscal year of 1871, estimated gross output $300,000; dividends during calendar year of 1871, $20,000.

For 1872, from $35,000 to $40,000 gross a month during the greater part of the year was estimated, but the record of dividends on the San Francisco Exchange showed only one of $5,000.

For 1873, dividends of $185,000.

In 1874, 25,146 tons of ore yielded $452,507 or $18 a ton at a cost of $7.16 a ton for mining and milling.

In 1875 it was said that since 1870 the production of the Keystone had averaged $1,000 for each working day. As the mill then in use contained forty 750-lb. stamps and had a capacity of 90 tons a day, this average, if correct, would indicate a yield of over $11 a ton for the period. The mine had then been opened to a depth of 750 ft. and for a length of 900 ft. The details of output from 1875 to 1888 are not at hand. However, the good grade of ore for which the mine had been noted gave out about 900 ft. in depth when the vein entered the greenstone. From 1888 to 1919, inclusive, the production was about $4,400,000. Keystone Mining Company were the last operators and ran the property from 1911 until October, 1919. They worked ore which yielded as little as $2.40 a ton.

### Mine Workings and Geology

The first official mention of the geology of the Keystone was by Dr. J. B. Trask, first State Geologist of California, in 1854. He reported the vein 3 ft. wide at a depth of 9 fathoms from the surface

in an adit 100 ft. long. At the end of this adit a shaft had been sunk through the lode 7 fathoms. There was a level 94 ft. long at the bottom of the shaft "with a power in the lode of five feet." The same writer in 1855 stated that "The lode at the depth of twenty-one fathoms has a power of nine feet for one hundred feet in length" and also that "At the depth of seventeen fathoms the ores lose the character of porosity which in the superficial ores was a striking characteristic, the cavities containing free gold." The Keystone vein in the upper levels had an average width of 10 ft. and the Geneva vein, 280 ft. east of the Keystone, was from 3 to 7 ft. wide. In 1867 a depth of 375 ft. had been reached and a length of 450 ft. on the strike had been drifted, all in ore. Professor Ashburner, in an early report on the Keystone vein, stated "The ground in many places is loose and the vein seems to have been subjected to great pressure, crushing the quartz to powder." The contact vein, with black slate footwall and altered greenstone hanging wall was a massive vein 12 to 200 ft. wide, but generally low grade. The pay occurred where side stringers made into the main vein from the footwall slate. These dipped 47° east. This massive barren vein occurs on the hanging-wall side of an important fault that has been traced 2000 ft. and dips east 35° to 65°. The vein is composed of fragments of greenstone and slate. The appearance of the mine in 1875 when it was known as the leading mine of the Mother Lode, is graphically described by Raymond:

"* * * The ore bodies in the slate which form the principal source of the company's revenue are of variable extent, sometimes expanding to a width of 20 ft. and again contracting to a mere seam. It has been noticed that the expansion generally occurs when the vein flattens, and contracts where it approaches a vertical dip. In consequence of this marked peculiarity in the west veins, the ground is prospected by vertical winzes which answer the purposes of horizontal crosscuts in more regular veins. By this means the mine always presents large bodies of reserves which would almost invariably have remained undiscovered by the usual system of prospecting. The Keystone has been explored to a depth of 750 ft. and a length of 900 ft. The longest crosscut is about 300 ft. On the east is found a well-defined wall of greenstone, carrying with it a vein of low-grade quartz. There is properly no footwall but a well marked line of fracture is found presenting the peculiar feature known as slickensides about 300 ft. west of the greenstone. Beyond this, exploration has failed to disclose bodies of quartz although a crosscut has been run 120 ft. beyond the line of fracture. The yield of quartz in this mine varies from $10 to $20 a ton."

On the hanging-wall side of the low-grade vein and separated from it by a dike of diabase, a small vein was found in a strip of black slate. This carried arsenopyrite and pockets of gold, the largest of which was found between the 800- and 900-ft. levels and was reported to contain over $100,000. The banded slate ore of the west vein was finally stoped for a maximum length of 800 ft. and an average width of 15 ft. down to the 900-ft. level.

Below 900 ft. in depth the main fissure passed into the greenstone, dipping flatter than the contact and traversing the greenstone to a point estimated to be somewhat below the 2100-ft. level, where, if it maintains its observed dip, it is presumed it will enter the east slate. This vein varied greatly in width however, being in one place 54 ft. wide, and only a seam on the 1400-ft. level; so its possibilities and its positive identification below may be uncertain. All workings have been inaccessible since 1920, and notes below are from the management.

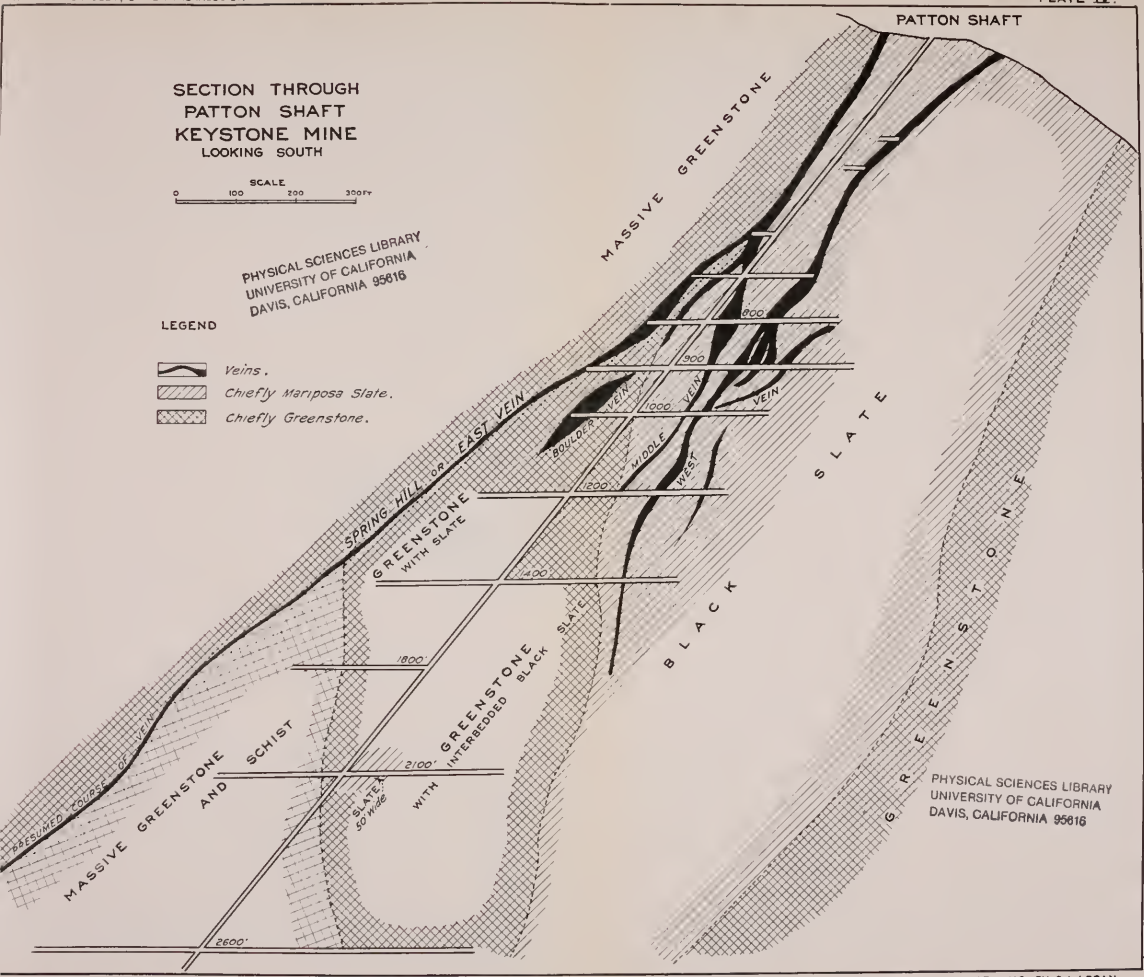
The main or Patton shaft was sunk 2680 ft. on 52° incline, being in greenstone from 1400 ft. to the bottom. On the 1200-ft. level, 800 ft. north of the main crosscut, an ore shoot parallel to main vein was found

which was reported 130 ft. long by 8 ft. wide, of 'gray ore' assaying $8 or more a ton. On 1400-ft. level, 150 ft. north of main crosscut, the vein branched. A drift was run 650 ft. on the west branch, which was reported to show ore 8 ft. wide at this place. A drift 270 ft. long on the east branch was in low-grade material. The gray orebody pitches south, being 400 ft. or more north of Patton shaft on the 1400-ft. level and 600 ft. south of it on the 2100-ft. level, where the orebody was 100 ft. long and was mined for a width of 18 ft. This 'gray ore' is mineralized greenstone on the hanging-wall side of the main contact vein. Ore was formed by the hydrothermal alteration (ankeritization) of the greenstone, during which gold-bearing sulphides, principally pyrite, were deposited forming a disseminated orebody in which most of the gold is associated with the sulphide.

On the 2100-ft. level, 1700 ft. of crosscuts were run and on the 2650-ft. level crosscuts were driven to both contacts of the greenstone and several hundred feet of drifts were run, but no ore was developed on this level within the Keystone ground. A block of ore remains above the 2100-ft. level on the gray orebody. The owners estimated in 1927 that there was 200,000 tons of proved ore that would yield $3 a ton at the old price of gold. The vein flattened on entering the greenstone to a dip as small as 20°, and this carried it far east of the original contact it had occupied. The crosscut west on the 2650-ft. level was run 690 ft. through greenstone and drifts were run 350 ft. north and 450 ft. south without developing ore. It was supposed that this work was on the downward extension of the so-called west vein so profitable above 900 ft. but this was of course not absolutely certain. Only a gouge-filled fissure was found in the slate. The crosscut was then run 500 ft. farther west, crossing a body of slate 380 ft. wide. In the south drift, 400 ft. south of the crosscut, another crosscut was run 275 ft. in the slate without finding ore. There was also a crosscut on the 900-ft. level 150 ft. east to Spring Hill vein, with a drift north on the vein 800 ft. and south 300 ft. At the 1200-ft. level a crosscut was run 320 ft. to the east vein and considerable work was done upon it, connecting with the old workings. There is an old south shaft 1124 ft. long on an incline of from 42° to 55° which was used for pumping.

The ore, as already noted, varied a great deal in value; the best of it in the deeper section of the west vein workings in the slate in the 1880's was several hundred feet west of the greenstone, was from 3 ft. to 40 ft. wide and yielded as high as $40 a ton. It carried from 1½% to 1¾% of sulphides, principally pyrite with some arsenical and antimonial sulphides, which yielded $110 a ton. On the basis of ore averaging $11 a ton this would mean about 15% of the gold in the sulphides. In 1906 at a depth of 1000 ft. with ore that yielded $2.43 a ton there was 2% of concentrate worth $63 a ton and carrying 52% of the gold and silver. In 1917 with ore of nearly identical yield, sulphides formed 4.3% of ore, yielded $53 a ton and contained 95% of the gold and silver. This last was the "gray ore" or ankeritized greenstone.

The last mill (still on the property) contained 40 stamps which, in the later operations, gave a reported capacity of 6 tons a day per stamp for an entire year. There seems to be a reasonable doubt that the mill gave an average capacity of over 4 tons per stamp per day. This




ACCOMPANYING BULLETIN 108. BY C.A. LOGAN.

would give an average recovery of about $3.80 per ton crushed from 1914 to 1919 inclusive. Vanners were used for concentration and no tailing was saved, as their gold content was very small. Recovery was about 90%.

During the last three years of operation most of the ore came from the 900-, 1000-, 1200-, 1400-, and 1800-ft. levels, the last three being most important, with little from the 2100-ft. level.

*Krueger and Vaughn* claims are near the Amador Queen No. 1 on the south. These claims were worked in 1852 using arrastres, and in 1855 some ore was milled, yielding about $7 a ton. Little appears to have been done after the work necessary for a patent was complete. These claims are on the east side of the main slate belt two miles south of Jackson.

*Lincoln Consolidated Mines* include the Lincoln, Belmont or Iowa, Stewart, Wildman, Mahoney, South Mahoney and South Lincoln patented claims, 11 small unpatented claims, mineral rights under town lots in Sutter Creek and other adjacent lands, 380 acres in all and covering about 5900 ft. in length along the Mother Lode. The holdings formerly were three separate mines, the Lincoln, Wildman and Mahoney.

History and Production

The Lincoln was located about 1851, and the others about the same time. All three were worked during the 1860's. The Wildman had a shaft 530 ft. deep and a 12-stamp mill in 1867. It lay idle from then until 1887, when it was reopened by Wildman Gold Mining Company. The Lincoln had two shafts by 1867, one 669 ft. deep and another 270 ft., and was said to have produced 3500 tons of ore annually from 1851[1] to 1867, except for two years. There was a 20-stamp mill and some of the ore was worth $15 a ton. The Mahoney had been opened to a depth of 500 ft. by 1873. The vein was 45 ft. wide then. It had been profitable to a depth of 250 ft., but below there was in low-grade material. The early-day production from the Wildman to a depth of 500 ft., the Mahoney to a depth of 300 ft., and from the Hector portion of the Stewart is estimated to have been about $1,500,000. The Mahoney was 900 ft. deep when bought by the Wildman Company in 1894.

The Wildman and Mahoney were worked by the Wildman Gold Mining Company until 1906, then closed down until 1910, when they were reopened and prospected until 1912, since which year they have been idle. The Wildman shaft reached a depth of 1400 ft. on 72° incline; Mahoney shaft, 1200 ft. deep on 62° incline, and Emerson vertical shaft 616 ft. The Lincoln, after lying idle about 30 years, was reopened in 1898 by Lincoln Gold Mine Development Company. The three groups were taken over by the Lincoln Consolidated Mining Company after 1906. The Lincoln shaft reached a depth of 2000 ft. on an incline of 63°. The Lincoln was not productive below the 500 ft. level, but the Wildman was stoped to about 1400 ft. and the Mahoney to 1200 ft. deep.

[1] Browne, J. Ross, Mineral Resources of U. S., West of Rocky Mountains, 1868.

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There were three periods of production for these mines, of which the first was the production from the shallow zone to a depth of 500 ft. in the Lincoln, 500 ft. in the Wildman, and about 250 ft. in the Mahoney. The exact figure for the total output for this period is unknown, but has been estimated at $2,000,000 for the Lincoln (probably excessive), and $1,500,000 for the Wildman and Mahoney, prior to 1887.

In 1898 and 1900 in the course of cleaning out the old workings and prospecting, $22,000 was produced from the second, third and fifth levels of the Lincoln.

The Wildman Gold Mining Company started with a 10-stamp mill, which was enlarged to 20 stamps, then to 30. From 1887 to May 1, 1894, they produced from the Wildman Mine 94,206 tons of ore which yielded a gross output of $417,561, after deducting freight and smelting charges on concentrate, and bullion refining charges.

From 1894 to October 1, 1901, they produced from the Wildman property 234,945 tons of ore of a total gross value of $834,671, or $765,347 after deducting for freight, smelting, etc. In the same period they produced from the Mahoney 269,681 tons which yielded a gross output of $518,037, or $439,471 after deduction of freight and treatment. Between 1895 and 1899, inclusive, the total average cost of mining and milling, including development and other improvements except enlarging mill, was $2.59 a ton. During this time, the operations at the Wildman yielded a net profit of $211,712. The operating loss at the Mahoney was $144,040. Each mine was equipped with a 40-stamp mill, containing 750-lb. and 950-lb. stamps. There is no record of any production between 1910 and 1912.

### Geology and Mine Workings

The Mariposa slate between the Old Eureka Mine and Amador City is interbedded with several narrow bodies of greenstone and the mines of the company are grouped around the slate-greenstone contacts. The andesite has been in part altered to amphibolite schist. Going north from the Wildman the vein increased to 45 ft. in width on the surface, and is said to have supplied much rich ore in the early days. It branched, or was split by a greenstone horse, at the north end of the Mahoney, one branch turning eastward into the Hector portion of the Stewart, with greenstone on the footwall, the other branch passing into the Lincoln with schist, and farther off, greenstone on the hanging wall. There was usually a heavy gouge, with ore at times on both sides of it. The ore in the Wildman and Mahoney was in the contact vein, along the schist-slate contact, in the upper levels. At depths reached in the earlier operations, namely about 500 ft. deep in the Wildman and 250 ft. in the Mahoney, the mineralization began to pass from the contact into the schist, where large bodies of low-grade altered schist, impregnated with pyrite, were found. The gray schist ore was on the footwall of the solid quartz vein. The wide section of rock on which mineralizing solution acted resulted in dispersal of the gold to such an extent that it was necessarily lower grade than if it had been confined to a narrow fissure. The schist dike was from 60 to 295 ft. thick. Mining in the contact vein continued to the 1300-ft. level, in the period between 1895 and 1899, the ore coming from

that vein between the 500- and 1300-ft. levels and being of low average grade. In 1899 the development of small ore-shoots found by diamond drilling in the schist dike began. As they had no dump room for waste on the surface, they milled everything that would pay for crushing, and the average grade was far below that needed to make ore, even at the low cost of operation.

After the Lincoln shaft was sunk to 2000 ft. a drift was run south over 2200 ft. passing through the Mahoney claim and to a point under the Wildman 1400-ft. shaft. Long crosscuts were run into the footwall from the 500-, 1200- and 1950-ft. levels of the Lincoln shaft, and on the 1200-ft. level one was run into the hanging wall, all apparently without finding ore.

In the Wildman Mine, the north drift on the 1400-ft. level was run 437 ft. and the south drift 666 ft. For a length of 250 ft. on the north, the vein averages 5 ft. wide, but the assay value is not known. In the south drift, according to information furnished from owners' records, ore began to make 193 ft. south of the shaft and increased to 25 ft. in width within 185 ft. A horse of ground had slipped into the fissure here, causing a pinch in the vein for about 75 ft. Beyond this, the vein began to widen again, increasing from 10 ft. just south of the horse to 100 ft. wide at the face. This latter width was sampled in sections of 5 ft. each, and the resulting average of the 20 samples was reported to be $3.62 a ton. The general pitch of the Lincoln-Mahoney-Wildman orebodies appears to be southward, as is true also in the mines nearby on the south.

*Little Illinois Mine* is on the J. H. Thomas Ranch containing 537 acres, lying to the south of the Pocahontas mine. Some work is reported to have been done here in the 1860's, but no record remains of it. It was reopened between 1908 and 1914, and a few tons of very good ore was reported crushed. The shaft was 147 ft. deep late in 1914 when last visited, and only 150 ft. of drifting had been done, 100 ft. of it in a shallow tunnel. It was closed down soon after, and has been idle since.

The workings are reported to have shown a vein with an average width of 5 ft., between slate footwall and greenstone hanging wall. Nothing is known regarding the prospects, as the last operator, Little Illinois Mining Company, left no records.

*Mammoth Mine* is on the 'black metal belt' in Spanish Gulch, adjoining the Valparaiso on the south. Its earliest history is unknown, but in the early 1880's it produced some rich ore. Between 1885 and 1888, a tunnel 8 by 8 ft. in cross section was run 3500 ft. northerly. For 3300 ft. no ore worth speaking of was found, except some small seams. When a point was reached about under the earlier strike, and 800 ft. below the surface, quartz increasing from small stringers to nearly the width of the tunnel was entered, and this carried some of the typical rich ore of the belt, containing arsenopyrite and gold. In 1886 there was a 10-stamp mill on the mine, but the rich ore was mortared by hand.

Little appears to have been done at this property in late years, the only recent record of production being of a few thousand dollars in

1924. Knopf[1] states the ore occurs "in horizontal veinlets of quartz that are restricted to the vicinity of the contact of black slate and greenstone. The veinlets follow horizontal joint surfaces, and most of them are but a few inches thick."

*Moore Mine.* This old mine (on agricultural land a mile and a half south of Jackson) had been idle over 30 years when Moore Mining Company began reopening it under option to purchase in August, 1921. There is no record of the results of the operations in the 1880's, during which the mine had been opened to 640 feet, on an incline of 52°.

When the shaft was reopened it was found that the fifth level (435 ft. inclined depth) which had been drifted 400 ft. in the heavy, crushed black slate in the main fault, was caved full. It was reopened, but did not carry pay. The black slate there is about 60 ft. wide. In a fissure branching from the main fissure, and striking nearly due east into the greenstone on the hanging-wall side a vein of quartz ribbon rock was found which carried from 4 to 12 ft. of ore. This gave such flattering prospects that a new 20-stamp mill and other buildings were erected in 1922 and the first ore was crushed in October of that year.

Work continued thereafter until June, 1929. It was found that the former operator had stoped down to the 340-ft. level. The shaft was deepened to 2291 ft. and a great deal of prospecting work was done, but resulted in one disappointment after another. Only small lenses or faulted segments of ore were found in the main fault fissure (Moore vein system) which had been relied upon to furnish tonnage of the character mined by Nevills in the old operations. Several other veins were prospected from the Moore shaft without revealing ore.

The total production reported from the Moore from 1922 to 1929, inclusive, was 92,935 tons yielding $564,624.

Geology and Mine Workings

The ground embraced in the Moore options covered on the west a narrow band of Mariposa slate traversing greenstone in a northwesterly direction, and on the east a complex of Mariposa and Calaveras slates, wider than the first belt of slates mentioned and parallel to it. The shaft is sunk on the easterly strip. The deeper work showed the Moore vein system, in and near the contact, badly broken by the contact fault. Ore was cut off about 750 ft. deep, and below there little ore was developed. Levels were opened at 640, 950, 1100, 1200, 1800, 1950 and 2100 ft. Small amounts of ore were found along the fault on the 1100-ft. north drift near the shaft and 500 ft. north of it. On the 1800-ft. level the Moore vein was found 170 ft. northeast of the station, and a length of 150 ft. gave some good assays, though it was not all of payable grade. This section was cut off on both ends by faults. When opened at 1500 ft. depth this shoot was found to be short. On the 1950-ft. level it was 50 ft. long by 8 ft. wide with an average value of $7 a ton, but was not found on the 2100-ft. level. The northwest drift on 1800-ft. level was run over 1200 ft. in search of further orebodies on the Moore vein, without success. The theories of several geologists as to the direction and amounts of movement of the supposed faulted orebodies on the dip and strike along the main fault were tried out

[1] Knopf, Adolph, The Mother Lode System of California: U. S. G. S., Prof. Pap. 157, p. 70, 1929.

unsuccessfully. Several other veins which cross the property were given names to identify them with veins in other properties, of which they were presumed by the Moore operators to be extensions. These included the 'South Jackson,' 'Aetna,' 'Zeila' and 'Kennedy-Argonaut,' and prospecting crosscuts and drifts were run to and along all of them. On the 640-ft. level a drift was run on the 'Aetna' vein. On the 1800-ft. level a long crosscut was run westerly to the 'South Jackson' vein from the north drift. On the same level a crosscut was run 1800 ft. to the 'Kennedy-Argonaut' fissure, the latter occupying at the surface the narrow band of Mariposa slate first mentioned hereunder. None of these disclosed ore.

The net result of the venture was a substantial loss to stockholders.

*New London* (*Lucille*) *Mine,* adjoining the Plymouth on the south, had been worked to a depth of 1130 ft. in 1888, and no record is available to show the production, probably because of the owners' refusal to give information. It was at that time part of a group covering 12,000 ft. on the Mother Lode. By 1890, the main shaft was 1340 ft. long on 65° incline and another shaft was 300 ft. long. The lower levels were run as follows:

1300-ft. level, 550 ft. south, 150 ft. north.
1200-ft. level, 630 ft. south.
1000-ft. level, 600 ft. south.

The 200-ft. and 300-ft. levels were also opened to work the upper ore-shoot. This shoot was reported 200 ft. long by 7 ft. wide. The lower shoot apexed at an inclined depth of 930 ft. and lay 400 ft. south of the shaft on 1000-ft. level but from what can be learned must have been short, as it seems to have been stoped for a length of only 50 ft. on that level.

After 1890, the property was idle until 1894 when the Lucille Mining Company reopened it and put up a 40-stamp mill, but shut down in a short time.

*North Star, McIntire, Boyson, Occident, Granite State* and part of *Beatrice* claim were under option in 1926 and 1927 to California McIntire Mining Company for which Fletcher Hamilton was agent.

A shaft about 1000 ft. deep on the North Star claim was unwatered to the 600-ft. level and considerable new work was done. The claims are on the Mother Lode north of Sutter Creek. The greenstone lies on the footwall, followed on the east by Mariposa slate containing the usual greenstone dikes or sills. Most of the work was done on the North Star and McIntire claims. The old work on the North Star, besides the shaft, included a crosscut southwest on the 600-ft. level and a drift 2500 ft. northwest into adjoining claims on a gouge and scattered quartz seams in the slate in search of a possible continuation of the South Spring Hill orebody, which is said to have occupied the same fissure. No ore was found.

The new work included a crosscut 100 ft. northeast to a contact of greenstone and slate with drifts 400 ft. each way on the contact, which was found to be frozen and barren; the southwest crosscut was also extended 500 ft. farther, making it 800 ft. long. Here the footwall contact of greenstone and slate was prospected. Two gouge-filled fissures, 50 ft. apart, were encountered. Going in a northerly direction

Underground scene, Old Eureka Mine of Central Eureka Mining Company, Sutter Creek, Amador County.

from this crosscut for a distance of 550 ft., the face reached a point 180 ft. from where the bottom of the 200-ft. McIntire shaft would have been, had this shaft been deepened. Southwest, these gouge-filled fissures were cut at several points, 400 ft. of new work having been done in that direction. The gouge and black slate showed only small scattered bunches and seams of quartz, and Roger Beals, who was superintendent, stated that assays showed nowhere over a few cents in gold, although it had been claimed that there was a prospect in the McIntire workings, on the 200-ft. level. This work off the southwest crosscut prospected the McIntire ground for 950 ft. The work on the hanging wall contact first mentioned prospected that contact on the east side of the North Star claim for 800 ft. Three crosscuts into the greenstone, each about 60 ft. long, developed nothing. The greenstone there is about 300 ft. thick. The old drift, 2500 ft. long, prospected the Boyson and South Keystone claims and a crosscut from it is said to have prospected part of the South Spring Hill claim.

Two conditions are noticeable in the workings on the 600-ft. level—first, the dryness of the ground, and second, the absence of any cross veins. The slate is plicated in small broken folds in places, and ground to gouge along the fissures with considerable quartz intermixed; but the very low reported assays indicate that the absence of ore is not due to faulting. The gouge has so completely dammed the fissures that although considerable water enters the shaft from the surface, and a small stream also runs along the lode, the workings are dry away from the shaft.

The company quit work about the middle of March, 1927.

*Old Eureka* (*Amador Consolidated* or *Eureka*) *Mine* was opened in 1852 and the first mill, of 10 stamps, was erected the same year. The mention made of this mine by Dr. J. B. Trask in his report for 1855 is interesting. This refers to the Eureka claim.

"The whim shaft A has been carried from 7 to 16 fathoms during the past year. The adit enters from the west and is about 100 feet in length. The upper gallery has been carried south of the adit 114 feet, and north 75 feet. The level at the bottom of the 16 fathom shaft is 144 feet in length. The rocks are a graphic slate, very firm and often charged with pyritic crystals.

"The rich thread, which commenced at the surface, and for fifty feet in depth, was highly pyritiferous; is found at the bottom of the main shaft much more productive. The pyrites have ceased entirely at this depth, and the hilo is composed of metallic gold, not disseminated, but forming a true vein, at times exceeding three-eighths of an inch in thickness. The vein has been struck in an adjoining mine about 1000 feet to the south. This is the only instance of a true vein of metallic gold having been found in this state."

The adjoining claim on the south was the *Badger* on which 10 stamps were built in 1854. A new 20-stamp mill was put on the Eureka in 1856 and 20 stamps more in 1857. Alvinza Hayward finally obtained control of both mines in 1859 and consolidated them. In 1867 the north shaft was 1230 ft. deep, middle shaft 960 ft. and the southern one 760 ft. deep. There were 56 stamps dropping in the two mills, crushing 80 tons a day, and ore was also sent to custom mills. Hayward, always secretive, refused to give details of production, but local report placed the output at $6,000,000 up to 1867. In 1866 it was said 30,000 tons had yielded $27 a ton at a working cost of $5 a ton. In March, 1868, the mine was sold for $750,000 to the Amador Mining Company. For 13 months ended October, 1868, the total yield was $566,945.92 or $21.88 a ton. For the year ended July 1, 1869 (overlapping the last period) 30,361 tons yielded $617,542 or $20.34 a ton.

South face, 8th floor, 1635 ft. On 2300 ft. level, Old Eureka Mine, at Sutter Creek, Amador County.
*Photo by courtesy of Central Eureka Mining Company.*

In 1870 the yield was $341,701 and in 1871, on account of a labor strike, only $201,357. For 14 months, December, 1872, to January, 1874, a total of 22,465 tons yielded $402,294 or $17.91 a ton. For 14 months ended April 1, 1875, the yield was $239,717 in bullion and $20,254 from concentrate, from 22,098 tons, indicating a marked drop in gold content of ore. In 1874 the 'boulder ledge' on the west of the 'true ledge' was being mined 30 ft. wide and was yielding $10 a ton on the 800 level. In 1875 it was evident from the superintendent's report that the upper shoot on the 'true ledge' was being bottomed at 1700 to 1750 ft. in depth. The shaft was continued as a prospect shaft to 1965 ft. At that time a large reserve of low-grade ore was claimed. Work finally stopped in 1881. A total of $12,000,000 to $13,000,000 seems a fair figure for the production during the 30 years of operation.

In 1916, a well-financed company bought the property and began unwatering it. The shaft was found in very bad shape on account of having been sunk in the Mariposa slate. It was deepened to 3500 ft. and levels were turned at 1700, 2125, 2950 and 3500 ft. and 1200-ft. level was reopened. On each of these except the lowest, from 1450-ft. to 1640 ft. of drifts were run. A crosscut was run west 800 ft. on 3500-ft. level. All of this exploration failed to reveal ore that would pay under conditions then existing, and the work was stopped late in 1920.

In 1924 Central Eureka Mining Company purchased the Old Eureka holdings and have done considerable work in it since, although this was mainly incidental to the working of its principal orebody on the south line of the Old Eureka until 1930, when the lower levels of Central Eureka were abandoned. Since then, Old Eureka has been more actively explored.

Geology

The main vein was found to have had a slate footwall with heavy gouge and greenstone (altered andesite) hanging wall in those workings that had furnished ore. The andesite extends for 800 ft. on the strike, and the ore was stoped for 450 to 500 ft. on the strike and evidently gave out, both on dip and strike, with the thinning out of the andesite, about the 1700-ft. level. The shaft and most of the other workings between 1700 and 3500 ft. in depth were in Mariposa slate, which is soft and swelling ground. The andesite lens thinned out to such an extent that it was no longer a factor in controlling fissuring, and the vein so far as explored was for the most part a mass of barren or low-grade stringers in the slate between these levels. Wide veins of low-grade quartz were coming in at the south faces of the 2950-ft. and 3500-ft. levels. The former level was run to the Central Eureka end-line. A number of crosscuts were run without striking ore, although many think that the possibilities in this exploration of the walls of the main vein had been far from exhausted when work was stopped. The longest crosscut was 800 ft. west on the 3500-ft. level. No ore of milling grade was found except a few small pockets.

The following are the positions of other veins with relation to the main Old Eureka vein.

Central Eureka lowest ore-shoot is reported about 300 ft. west of Old Eureka vein at the common end-line at 3500 ft. in depth. Due to the direction of this end-line the length of the original Central Eureka claim along the strike shortened rapidly in depth. This vein was reported low grade where crosscut in the Old Eureka. As the later developments in the Central Eureka on this ore-shoot have been principally below the 3500-ft. level and have extended to date to 4850 ft. in depth, and several hundred feet north of their shaft, this is an example of the uncertainties of mining. The purchase of the Old Eureka prevented possible expensive litigation.

The Railroad vein is about 500 ft. east of the main Old Eureka vein. It produced $70,000 to a depth of 340 ft., the reported grade of ore being good.

The Wolverine vein is probably a little in the footwall of the Old Eureka.

The Wildman-Mahoney vein and the Lincoln vein are several hundred feet west.

*Original Amador Mine* is said to comprise the first group of locations made in Amador County on the Mother Lode. It was opened in 1852. At present it contains the Original Amador, East Amador, Amador Wedge, Great Eastern, Eclipse Extension and Last Chance claims, covering 4400 ft. on the Mother Lode. The geology and mine workings were described by James D. Hague in 1872, and his report is outlined in the next two paragraphs.

The underground workings extended 650 ft. northwest from the south boundary. There were three shafts, of which the south shaft was 175 ft. deep, the middle one, 196 ft. northwest from the first, was 356 ft. deep, and the third shaft was just started. The vein, having hanging and footwall seams, varied from one to 20 ft. wide, had a hard, slaty-greenstone hanging wall and black-slate footwall. The hanging-wall vein was usually the larger, was of hard, white quartz, frequently mixed with greenstone and sometimes joined to the greenstone of the hanging wall with no gouge nor well-defined limit between. The footwall vein was narrower, and in the black slate. It showed an abundance of clefts or crevices in which were seams of sulphurets and visible free gold. This vein was always the richer of the two, and was stoped in the old workings (above 356 ft. in depth), while the hanging wall vein was left. The veins at times were together, at times separated. Below the third level the vein pitched east into the greenstone, with 50 ft. of greenstone between the vein and the footwall slate.

A 40-stamp mill was completed in 1872, an English company having purchased the property. About 3600 tons of ore crushed yielded from $4 to $6.50 a ton, and the tailing loss was $2.50 to $3.26 a ton. This company spent considerably more than they took from the mine during the next two years, but no complete record of their work remains.

The later work by Original Amador Consolidated Mines Company began in 1908. The property was one of the smaller producers of the lode until 1918, since which year it has lain idle. The production between 1910 and 1918 was between $90,000 and $130,000 a year. The operations were profitable in spite of the general low gold-content of ore, and permitted the purchase of the claims adjoining the Original

Amador. From 1909 to 1915 a mill of twenty 1000-lb. stamps and 8 Deister concentrators was operated. This had a capacity of 90 tons a day. The ore crushed during this period came largely from development work and averaged $3.44 a ton with a reported average operating cost of $2.56 a ton.

In 1915 the capacity of the mill was trebled, with the installation of two 8-ft. by 3-ft. Hardinge mills, classifiers, etc. There was some falling off in average grade of ore thereafter. A large tonnage of low-grade ore was claimed to have been blocked out. About this time some landowners began to complain of alleged damages to their land from tailing and in some cases to demand payment therefor; and in 1917 the California Debris Commission addressed protests to several mine owners about tailing entering streams. Both the Keystone and Original Amador companies were put under bond in June, 1917, in this connection. The latter closed in 1918 after having made a greater production in 1917 than in any previous year. The last full year's output was low grade.

Mine Workings and Geology

The mine is opened by an inclined shaft 1238 ft. long with 9719 ft. of drifts, 7023 ft. of crosscuts and 27,465 ft. of raises. The geology of the upper section has already been mentioned. The main vein left the contact of Mariposa slate and greenstone and entered the greenstone about the 300-ft. level and assumed a much flatter dip below there. The shaft, which had followed the vein to 300 ft., was in the footwall of it below there, and also in the greenstone. The ore on the hanging wall vein below the 300-ft. level was partly from the vein itself and partly altered greenstone lying on the hanging-wall side of the quartz. The vein proper is said to be 15 ft. thick or more, and because of its flat dip showed a width on the level up to 90 ft. according to Knopf. East of this vein, parallel veins of 'gray ore' consisting of quartz stringers and altered greenstone, have yielded ore. According to Tucker, these are from 12 to 20 ft. wide. As the mine was not visited by a representative of this division between 1914, when the shaft was 780 ft. deep, and the time of closing in 1918, the details of geology below there are not at hand.

The footwall vein which was chiefly worked in the earlier operations on the upper levels is reported narrower and better grade than the main vein, which it joins north of the shaft. It is a stringer lead in slate, 6 to 8 ft. wide.

In the main vein shrinkage stoping (top slice and fill) was used because of the firm walls and width of ore, and this, with the moderate depth, permitted low-cost operation.

The mill made a recovery of 90%. Concentrates formed from 1½% to 2½% of ore. They ranged from $40 to $75 a ton in value and contained usually from one-third to one-half of the gold.

Little stoping was done below the 700-ft. level, the ore milled from below there having come from drifts and raises run in the course of development work. The 700-, 800- and 1200-ft. levels were each run several hundred feet north and south of the shaft, it being claimed that low-grade ore is exposed for a length of 1000 ft. on the 700-ft.

level. This level corresponds nearly in elevation with the 800-ft. level of the Keystone.

The work of unwatering the Original Amador was started in August, 1934. It is reported that the same company may also take over the Bunker Hill Mine, adjoining on the north.

*Pioneer Mine* adjoins the New London on the south about one-half mile south of Plymouth, and like the latter lies about midway in a mile-wide area of Mariposa slate. The period of principal activity appears to have been in the middle 1890's, when the largest recorded annual production was $15,000. The shaft was 550 ft. long on an incline of 60° and five levels were turned, 100 ft. apart.

It contains two veins, the east vein of massive quartz and a west vein of banded quartz which is said to have contained the best ore. The shaft was sunk on the latter. While some good ore was produced in the upper levels, it is said that in the bottom the quartz was low grade.

*Plymouth Mine*

The holdings include the Southerland, Oaks and Pacific, Simpson and Aden, Reese, Phoenix East, Plymouth, Phoenix Mill site, Reese and Woolford, fractions of the Indiana, Rising Star, Conville and lode claim 5181, the Beta claim and 22.77 acres of other land, a total of 126.3 acres, all in Sec. 11, T. 7 N., R. 10 E. Most of the ore was produced under the Simpson and Aden and Oaks claims.

History

The claims forming the present Plymouth Mine were originally taken up in 1852. The Southerland, Simpson and Aden claims were known as the *Phoenix Mine*, which was opened in 1859. Up to 1875, this had been worked steadily and in the latter year had two shafts, 200 ft. apart and each 900 ft. deep. Ore occurred in a "large body of low-grade quartz" and was worked at a cost of $5.50 a ton. Soon afterward the Phoenix holdings were sold to the Empire Company, and by 1879 the shafts now called the Empire north and south shafts, were 1200 and 1280 ft. long, respectively, or 1020 and 1100 ft. deep vertically, where sinking stopped. Ore averaging $9 a ton was then being mined between the 1000-ft. and 1100-ft. levels, on the main Empire ore-shoot. The North Empire ore-shoot was found in 1881 in a drift run north on the 900-ft. level, and was stoped from the 900-ft. to 1200-ft. level.

The *Pacific* vertical shaft (which became the main working entry in later years) was started in May, 1880, and was 1000 ft. deep by October, 1880. The southward rake of the main Empire ore-shoot carried it under the Oaks claim of the Pacific Mine, where it was mined by the Empire Company. The resulting lawsuit was won by the Pacific Company, and this led to the consolidation on June 1, 1883, under the name of Plymouth Consolidated Mining Company. The Woolford shaft was sunk 400 ft. deep in 1885.

The production of these mines prior to consolidation was reported about $2,500,000. Soon after they were grouped, the property became the principal producer of the county. As many as 147 stamps were operated by water power. From June 1, 1883, to January 1, 1888,

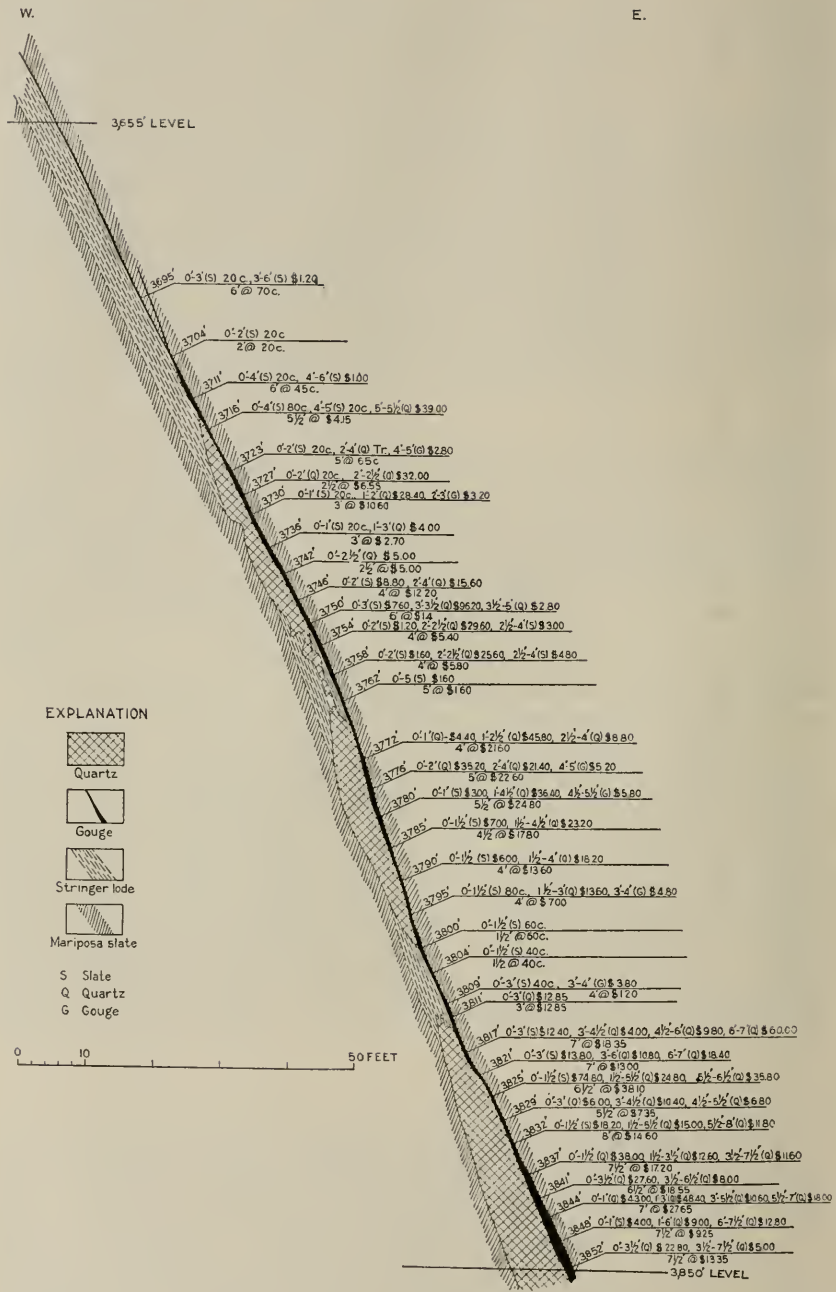
the company produced $3,804,499 from which 55 dividends totaling $2,200,000 were paid. On January 24, 1888, a fire was reported on the 1200-ft. level and was not finally reported as being extinguished until the mine was flooded. This fire is alleged by some to have occurred just when good ore appeared to be giving out. The Pacific workings were reopened in 1889, and in the four years following produced $215,518. From the above figures it would appear that the total production by the old companies up to the complete cessation of work in 1892, was $6,520,017. In a report by Albert Burch in 1911, it was stated, however, that the old companies up to 1891 produced $7,123,009.56 from 877,000 tons with a net profit of nearly $3,000,000 and that bullion produced amounted to $6,659,079.11, the balance presumably having come from concentrate and tailing. Between 1898 and 1902, about $44,000 was produced from the old tailing dumps.

The mine lay idle from 1892 to 1911, when the Pacific shaft was reopened and a winze was sunk from below the 1600-ft. level to 2000 ft., developing ore enough to result in the formation of Plymouth Consolidated Mines Company, Limited, in London, with a capital of 240,000 shares of one pound sterling; 204,482 pounds sterling was paid for the property. From August 1, 1914, to the end of 1924, a total of 1,037,373 tons of ore was milled and yielded $5,718,889. Dividends paid from these later operations amounted to $758,000. After 1920, however, the cost of operation increased until it equaled or at times exceeded yield. In February, 1925, the mine was forced into receivership to protect a local loan, and was sold to Argonaut Mining Company. The workings had by that time reached an inclined depth of 4300 ft. (the shaft below 1600 ft. having been turned to an incline of 60°.) The principal known orebodies had been worked out to this depth.

Argonaut Mining Company sank the shaft from the 4300-ft. level to the 4450-ft. level and milled some ore which added $515,292 to the production, from 1925 to 1928, inclusive. They decided, however, not to appropriate the sum needed to put the mine in proper shape and sink another 150 ft. The only work done since 1928 has been some prospecting on the upper levels, which stopped in 1931. Taking the larger of the figures quoted for production prior to 1889, the Plymouth holdings have produced $13,357,190 from 2,029,710 tons of ore. From this, if we estimate dividends of $750,000 for the operations prior to June 1, 1883 (when ore of much better grade was handled than later) the total dividends were about $3,700,000 or nearly 28% of total production.

## Geology

The Mariposa slates at Plymouth are a mile in width and it is entirely within these slates that the payable ore has been found. On the east, the Mariposa formation is separated from an outlier of one of the granodiorite domes of the Sierra Nevada batholith by a strip of amphibolite schist only one-fourth mile wide. This schist has been referred to the Calaveras formation (Carboniferous), and it is believed to have been originally andesite. The andesite cut in some of the mine workings is believed to have had an important influence on the position of ore. Some sandstone, formed of chert fragments, and some conglomerate are found in the Mariposa formation, but it is typically a




Distribution of gold and structural features of typical quartz vein inclosed in slate, Plymouth Mine. Reproduced from U. S. G. S., Prof. Paper 157, p. 28. Geology by Robt. J. Duncan.

black, carbonaceous clay slate with small intrusions of basic igneous rocks and beds of clastic volcanic material which originally were spread out as mud flows of andesite or similar volcanic ash on the ocean floor at the time the Mariposa beds were being deposited. The present dip of the schistosity of the slate is nearly vertical, but unlike the usual dip in most sections it is to the west. Though tilted and telescoped, and rendered slaty by pressure, the Mariposa beds are otherwise little changed.

The Calaveras formation (Carboniferous) on which the Mariposa beds rest, is another complex of altered rocks, which were in part originally sedimentary and in part igneous. All the members of this formation have been intensely altered and the igneous members have been so completely changed both in physical structure and chemical content that they are now greenstone schists, locally called amphibolite schist. Malcolm Maclaren regards the contact between the Mariposa slate and the amphibolite schist on the east as a fault contact, dipping east at an angle of probably about 60°.

## The Veins and Ore-Shoots

Three systems of lodes have been found, comprising main veins and spurs, and called the Empire, Reese and Woolford and hanging-wall contact veins. The most important, the Empire, is believed to occupy a fissure opened by a reverse fault, on the footwall side of the mine. In the deeper levels it is the typical slate-quartz stringer leads or 'ribbon rock' of the lode. This is the vein opened in the Phoenix workings and followed to a depth of 1200 ft. in their old shafts prior to consolidation. It does not outcrop prominently except on the New London claim. Its strike is generally north and dip 62° east, cutting across the schistosity of the slate at a small angle in dip and strike. The Phoenix or Empire ore-shoot was in this vein, having its apex in the Simpson and Aden claims. It raked at a flat angle, 40° to 50°, to the south, and this carried it into the Oaks claim which was being worked by the Amador Pacific Company through the Pacific shaft. From the surface to about 400 ft. it was of only average grade, and from there to 1000 ft. even lower, so that between 600 ft. and 900 ft. much of it was left unstoped. From 1000 ft. to 1500 ft. it was richer, and in 1886 out of a gross production for nine months of $447,547.13 there was a profit of $254,402.13 above operating expenses, and dividends of $225,000 were paid. The ore-shoot was claimed at that time to be 800 ft. long. The 1500-ft. level was just being opened and no ore had been stoped there; but it is not certain if the 800 ft. in length referred to the Empire shoot alone, or to the combined length of it and the Pacific ore-shoot. The vein was reported averaging 30 ft. wide and containing 1½% of concentrate worth $135 a ton. The average value of this ore was $6 to $8 a ton. In the upper levels this ore-shoot was 450 ft. in horizontal length. It is said to have lain on the footwall down to the 1000 ft. level, and below that on the hanging wall. Pacific vein is considered as a spur of the Empire leaving it a little north of the Empire north shaft and striking a little east of south to near the Indiana shaft, where the Indiana vein has the appearance of a hanging-wall spur. Maclaren connects this vein with the New London. Three ore-shoots were worked in the Pacific between the

1600-ft. level and 835-ft. level, above which they are said to have died out. All three were on the south side of the Pacific shaft. Their occurrence is attributed to the junction of the two veins. They rake toward the Empire shoot, and the vein in which they lie dips 80° E., so that the Pacific and Empire shoots merged about the 2000-ft. level. Below there the rake of the ore becomes perpendicular. No details are at hand regarding the Pacific operations, but some interesting items were observed when the shaft was unwatered in 1912.

Main Ore-Shoot in Depth

From the 1140-ft. level, ore had been stoped for nearly 200 ft. in length and the back gave an assay of $19.34 over a width of 41 inches. On the 1600-ft. level, a vein 16 ft. wide was exposed in the old working, but it was too low-grade to make ore. This drift was extended south. Finally, ore 5 ft. wide was developed for a length of 255 ft. and with an average value of $6.96 a ton on this level. On the 1850-ft. level, the ore-shoot proved to be 334 ft. long, with an average width of 4½ ft. and average value of $6.32 a ton. There was a heavy post-mineral gouge on the hanging-wall side on this level. Below there, the orebodies decreased in size but held up in value to about the 2450-ft. level. From there to the 3050-ft. level, the main vein was poor or unpayable, and was also disappointing between the 3235- and 3650-ft. levels. From the 3400-ft. level about 380 ft. north of the shaft, a winze was sunk and in 1922 struck ore which developed a stope length of about 100 ft. to 180 ft. and a thickness up to 9 ft. Some 20,000 tons of ore mined from this ore-shoot averaged $10 a ton. In the workings above 3835- and 2925-ft. levels this ore was crushed 'ribbon rock' with gouges on both walls varying from a seam to 1½ ft. in thickness. In the 3925-ft. level it showed 9 ft. of ribbon quartz, broken and sugary in texture from faulting, and containing visible gold in places. In spite of the good grade of this ore, the expense of working through the winze was too high to permit a profit. The shaft was eventually sunk, after this ore had been mined.

The Reese and Woolford vein has not contributed payable ore. A shaft was sunk on it to a depth of 400 ft. in the 1880's. The Chicago or hanging-wall contact vein likewise has no productive history here.

The Indiana vein, by some regarded as a cross vein cutting off the Pacific vein on its southward strike and by some as a spur from the latter, has a shaft connecting with the 950-ft. level of the Pacific shaft, nearly 1000 ft. south of the latter. Part of the Pacific south ore-shoot was worked through this Indiana shaft which is kept equipped now with a hoist.

The ore in the Empire ore-shoot has always been bounded on the north by a meta-andesite dike entering from the footwall side. This outcrops 2850 ft. north of the Pacific shaft, and had a thickness of about 100 ft. where crosscuts have passed through it. The gouge and ore stop at this dike which persists to the greatest depth yet reached. In the lower levels the andesite turns away from the shaft on a curved course indicating that it may be lens-shaped. On the 4450-ft. level the northern end of the orebody is now 800 ft. north of the main shaft.

Ore-shoots appear to have occurred at and near vein intersections or the junctions of spur veins. Contact zones between the slate and

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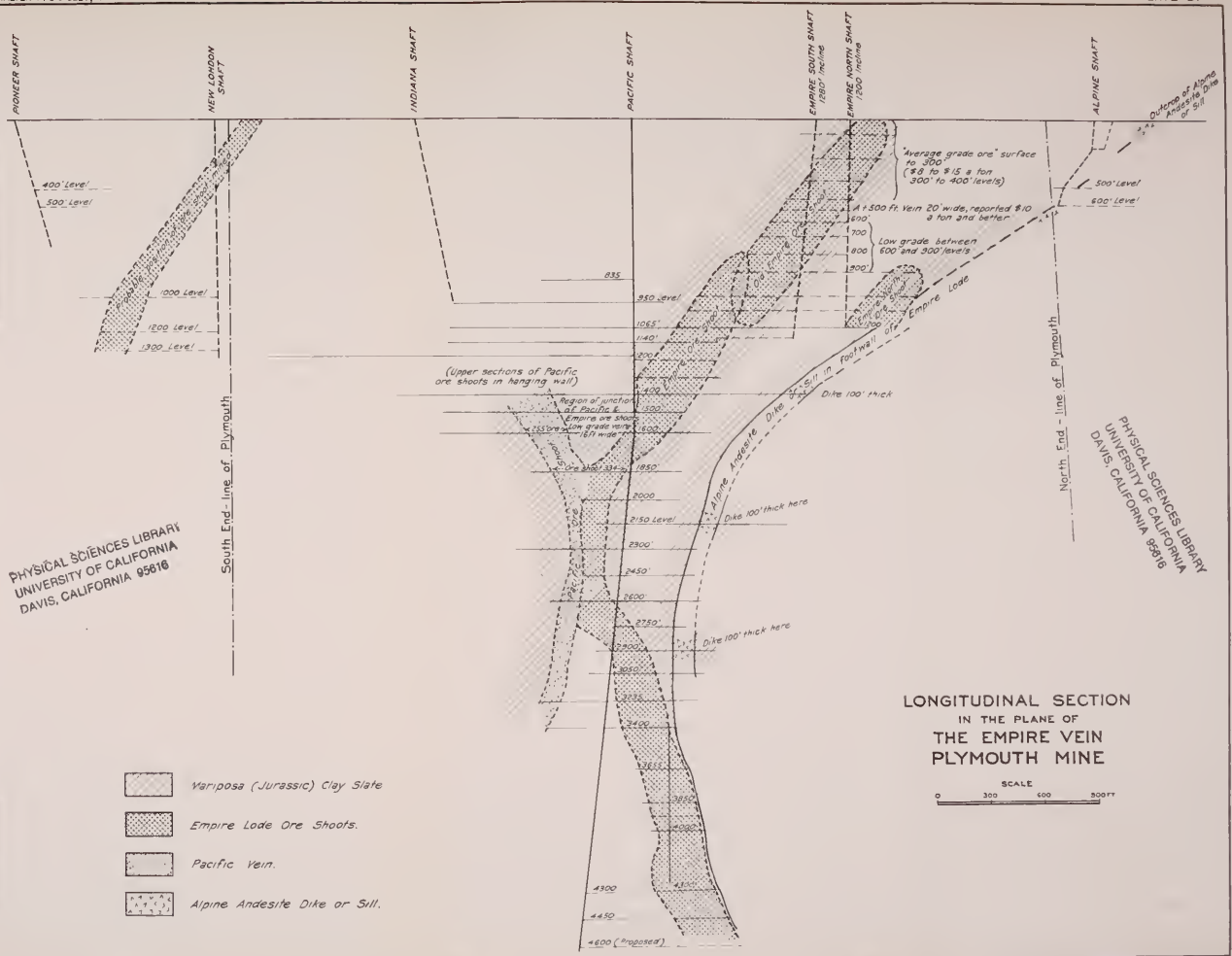


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# LONGITUDINAL SECTION
IN THE PLANE OF
# THE EMPIRE VEIN
# PLYMOUTH MINE

SCALE
0 300 600 900FT

interbedded andesites seem to have been a controlling factor in determining the location of veins, as well as of ore-shoots. The accidental occurrence of open spaces in the main fault fissures or adjacent spurs was another factor.

Equipment

Some of the equipment for mining and milling formerly in use has been removed or has deteriorated, but larger items are intact. These include 30 stamps, 4 Hardinge mills, Nordberg hoist with 500 h.p. motor, 3 compressors with motors of 400, 75 and 160 h.p., respectively, steel head-frame, rock breaker, 3 air receivers, 7 transformers, about 20 electric motors, timber framing equipment, drill sharpener, etc. The hoist building and some others are in good shape, but the mill is not. There are 5 dwellings belonging to the company. The method of ore treatment has often been described and is alluded to under Metallurgy.

*Seaton (Peerless) Mine,* a mile east of Drytown and adjoining the Maryland on the south, covers 1260 ft. along the east side of the lode, in the strike of the Loyal Lead. Previous to 1868, the Seaton had been opened to a depth of 500 ft. and it was stated had produced 10,000 tons of ore that yielded $9 a ton. The 40-stamp mill was later burned and the mine lay idle for many years; in two later short periods of activity it was reopened and the shaft was sunk to a depth of 950 ft. on an incline of 65° and a length of 600 ft. was prospected. Another shaft was sunk 500 ft. There is no record of further production, though the total up to 1885 is claimed to have been important. The vein at the surface has a Mariposa slate footwall and greenstone hanging wall. On the 800-ft. level the width was reported two ft.

*South Eureka Mining Company* owns 401 acres, including practically all mineral rights between the Kennedy and the Central Eureka and covering the *Oneida* and *South Eureka Mines.*

History and Production

The *Oneida* was one of the richest of the early-day producers. The ore on the hanging-wall side was the best, yielding $30 to $40 a ton, according to J. Ross Browne.[1] The average yield in 1867 was $22 a ton and in 1868 it was $16 a ton.[2] In 1871 there were three shafts, 300, 700 and 800 feet deep, respectively. The vein was drifted for a length of 800 ft. on the 700-ft. level, and the ore-shoots were said to have been 700 ft. and 400 ft. long. These old workings finally reached a depth of about 1000 ft., after which the property lay idle until 1896. In that year a new vertical shaft was started and it was expected this would strike the vein at a depth of 1750 ft., but on account of the vein assuming a steeper dip, it was not struck until the 1900-ft. level. This shaft reached a depth of 2280 ft., and an inclined winze was sunk 250 ft. deeper at a point 280 ft. north of the shaft. The mine was worked extensively from the 1200-ft. to the 2200-ft. level. On the 1200-ft. level, the vein was drifted 2700 ft., on the 1500-ft. level 2050 ft., and on the 2000-ft. level about 2300 ft. Ore was stoped from the latter

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[2] Raymond, R. W., Mineral Resources of the U. S., West of the Rocky Mountains, 1869.

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level to the old workings. A 60-stamp mill was used. Operations continued until 1913, since when the mine has lain idle except for some work done through the South Eureka shaft.

Only fragmentary figures are at hand for the earlier production. For eight months prior to June 1, 1867, a yield of $135,000 from 7710 tons of ore was reported, at a cost of $5 a ton. For less than four months in 1868 the output was $60,400 from $16 ore. The mine at that early date had 60 stamps; 40 weighed only 450 lb. each and 20 were of 650 lb. weight. By 1872 the average yield had dropped to $10 a ton.

For the period from 1898 to 1910, inclusive, the production was about $1,500,000. The yield during this time was from $2 to $3.75 a ton. The total production before sale to the South Eureka Mining Company has been estimated at $2,500,000.

The *South Eureka* lay undeveloped until 1891, due probably to the fact that most of the surface along the course of the Mother Lode fissure through the property is covered by andesite cobbles. In that year an inclined shaft was started which finally reached a depth of 2785 ft. To a depth of 900 ft. the fissure was filled principally with crushed slate and gouge, containing only a little quartz. The ground was very heavy and the shaft expensive to keep open on account of having been sunk in this crushed slate. On the 900-ft. level, a crosscut revealed some ore on the east contact (hanging wall) of black slate and greenstone, but for the most part the ore was scattered in bunches in the gouge-filled fissure and did not make a good-sized or profitable ore-shoot. For ten years assessments were levied to continue prospecting. During this period a 20-stamp mill was in use part of the time. After 58 assessments had been levied and the 2740-ft. level had been reached, a crosscut to the footwall encountered an important ore-shoot. This was subsequently developed by crosscuts from the higher levels, and was stoped up to about the 2000-ft. level. The mill was increased to 80 stamps and the property for several years was one of the largest producers of the county, employing from 200 to 250 men. They quit in 1918.

In 1921, the Central Eureka Mining Company took an option on the property and extended several of their deeper levels into the South Eureka. The 3350-ft. level south drift was run to a point 120 ft. north of where the South Eureka shaft would be if continued. A west crosscut was run in greenstone near the north end-line of the South Eureka on this level. On the 3900-ft. level, the drift was extended about the same distance into the South Eureka, and a crosscut was run east in slate 740 ft. This cut several gouge seams and vein formations but no ore was found. The 4100-ft. level was also run into the South Eureka. The result of all this work was disappointing.

Since the South Eureka Mining Company quit, the shaft as far far down as the 2740-ft. level, and the workings connecting the two mines on that level (Central Eureka's 2540-ft. level) and on the 1800-ft. level (Central Eureka's 1600-ft. level) have been kept in repair by the Central Eureka Mining Company. Water from the lower part of the Central Eureka Mine is pumped to their 2540-ft. level and piped thence to the South Eureka pump station which is maintained and operated by the Central Eureka Mining Company. The South Eureka shaft,

over which the hoist is kept in running order, also serves as a second exit.

From 1895 to 1908, inclusive, the property was only a moderate producer from the small orebodies of the hanging-wall vein. This ore ranged from $2 to $6 a ton in yield and the total output was about $1,200,000 for this period, representing the exploitation of the hanging-wall vein from the 900-ft. to 2700-ft. level.

Following the discovery of the footwall vein system in 1908, the mine at once became an important producer. The 20-stamp mill not proving sufficient, at first 10 stamps of the Central Eureka Mill were rented, and then the South Eureka mill was increased to 80 stamps. Dividends began in 1909 or 1910. There was a gross production of about $4,100,000 from over 980,000 tons of ore from 1909 to the time of closing in 1917. The total amount of dividends is not known, but if local reports are to be relied upon, must have been about $1,000,000. Operating costs were relatively low. In 1911 mining and milling cost was said to be $2.63 a ton and monthly dividends of $21,000 were reported. In 1915, operating cost per ton milled was $3.275 and dividends for the year were said to be $125,354.

## Geology and Mine Workings

On account of the outcrop of the lode being covered on the South Eureka by the capping of an ancient stream channel, the surface gave little encouragement for quartz prospecting. The sinking of the shaft was therefore a speculative venture, based on the position of the claims between known producers on a well-defined gold-bearing structure. Two lines were surveyed across the property following the direction of strike of the lode as exposed in the Eureka mine on the north and in the 1650-ft. level of the Kennedy on the south. These proved to be about parallel and 100 ft. apart on the surface of the South Eureka. Midway between the lines an inclined shaft was started in the black slate which was soft, crushed and heavy. It proved to be expensive to keep open, requiring continuous retimbering and realigning. Crosscuts were run to the hanging-wall greenstone at 500, 600 and 900 ft. inclined depth. The work to a depth of 900 ft. gave little ore, as previously noted. The crosscut at 900 ft. showed an ore-shoot up to 5 ft. wide at the contact. The greenstone on the hanging-wall side of this had been sufficiently mineralized to become ore, and on the footwall side of the vein there was also a "rich pay streak from 1 inch to 10 inches in width, heavily sulphuretted and high grade." In 1900 the shaft had reached 1800 ft. in length. The vein was reported much disturbed by faults, with rich ore occurring in bunches in the slaty gouge.

The beds of Mariposa slate in which the Mother Lode occurs here lie between two belts of greenstone. The shaft cut the hanging wall vein at the 1700-ft. level and followed it to the 2000-ft. level, near which this vein entered the greenstone and the shaft passed into the slate. The slate belt is several hundred feet wide. The so-called footwall vein is one of several worked in the lower levels. It was found by following a spur or link vein from the contact region into the slate where it joins the footwall vein which is about 250 ft. west of the

contact. It was followed upward from the 2740-ft. level to above the 2000-ft. level.

In winzes and drifts below the bottom of the shaft it was found the main ore body was only 60 ft. long on the 2900-ft. level. It raked north and crossed the line into the Central Eureka on the latter's 2700-ft. level, but went only 30 ft. below there.

The mill contained eighty 1,150-lb. stamps, dropping 6½ inches 100 times per minute and crushing five tons each daily through 24-mesh screen. After outside amalgamation, the pulp passed to 48 six-ft. Frue vanners. The saving was from 85% to 91%. Concentrate formed from 1.7% to 2% of the ore, and carried from $60 to $72 a ton in gold and 40 to 65 cents in silver.

*South Jackson Mine,* one-half mile south of Jackson, was worked by a company of the same name from 1912 to 1915. It is on an agricultural patent (Meek Ranch) covering part of the eastern band of Mother Lode slates. Three stringer leads were prospected. A vertical shaft was sunk 577 ft. with levels at 210, 345 and 500 ft. On the 210-ft. level a crosscut was run 90 ft. west. On the 345-ft. level a west crosscut 280 ft. long cut a vein 80 ft. from the shaft, and this was followed north 312 ft. and south 383 ft. showing 5 ft. of quartz in each face. On the 500-ft. level a crosscut was run 1035 ft. east cutting the middle vein 20 ft. from the shaft; this vein was drifted on 260 ft. north and 130 ft. south. A vein which they called the Zeila was struck in this crosscut 750 ft. east of the shaft and a drift was run north 100 ft. on it.

In January, 1915, South Jackson Mining Company announced they had spent $104,000 but were disappointed with the results of their work, as the amount of ore found did not justify a plant. After crushing less than 200 tons of ore at a custom plant that year, they closed the property which has since been idle.

*South Keystone Consolidated Mining Company.* This was the company which did considerable work in 1917 and 1918 on the North Star (which see), Boyson and South Keystone claims. They made no production.

*Valparaiso Mine* is on a narrow strip of Mariposa slate enclosed in the greenstone and extending from the Argonaut Mine to Spanish Gulch where it joins the main slate belt. The mineral zone along this slate and its contacts is locally called the 'black metal belt' because the gold is coated black and possibly because of the rich sulphides, often carrying much more gold than usual on the lode. The Mammoth Mine adjoins on the south. The gold occurrence is pockety.

An adit 1300 ft. long was completed on the Valparaiso claim in January, 1888, and the three men who drove it were each given a one-twelfth interest in the claim for their work. It extended to within 200 ft. of the south line. A Huntington mill was put on the claim the same year. It was thought at the time that a rich and well-defined ledge lay in the hanging wall of this adit. The later production, however, was in the form of small tonnages of fair to high-grade ore. No record is at hand of the first ten years' output after 1888. From 1898 to 1931, inclusive, the Valparaiso is credited with a production of over $100,000. The estimated value per ton of the ore milled ranged from $9 to $500, as much of the gold came out in the form of 'pockets' or

'specimens' and the ore crushed was the residue mined in cleaning up around such bunches. Some winze workings and exploratory crosscuts were driven in later years. The concentrates from this mine are reported to have carried at times as much as 37 ounces of gold per ton and formed 5% to 6% of ore.

The geology is very similar to that of the Amador Queen No. 2 and Mammoth Mines.

*Zeila Mine* (originally called the Coney) is at the southeast side of Jackson, and the original mining claims with mineral rights acquired on ranch lands cover a mile along the contact of greenstone and Calaveras schist.

In the 1860's it had been worked to a depth of 200 ft. and for 300 ft. on the strike. There was a 16-stamp mill in 1867 and the ore at that time was said to be yielding $13.50 a ton, of which $6 a ton was said to be in free gold. A chlorination plant had already been erected to treat concentrate, which was said to form 5% or more of ore. By 1875, however, after a depth of 600 ft. had been reached, work had been stopped and the mill had been dismantled, because of "refractory rock." It was reopened about 1880 and was a producer every year until 1914, since which date it has lain idle and has passed into the possession of the Kennedy Mining and Milling Company.

Few details were ever given out concerning the results of operation and as is natural in such cases the output of the property has been overestimated. Because of the low grade of ore and the size of orebody, there was a certainty of performance which made for low cost of operation, and if the figures for the Zeila were obtainable, they would probably prove as low as, if not lower than any others for operation at any considerable depth on the Mother Lode. W. F. Detert boasted that although the Zeila was never even a $4 proposition (during his time) it had been a steady dividend payer ever since it was placed under his management. The output was about $5,000,000 for the 34 years ended in 1914, and in the later years at least, the average recovery was between $3 and $4 a ton. The stock was closely held and the amount of dividends was never revealed. A 40-stamp mill was operated most of the time.

## Geology and Mine Workings

No reports on the mine have been printed since about 1900. In 1890, Fairbanks stated (Report X of the State Mineralogist) that

> "At the Zeile there are several veins worked. The hanging walls are usually of decomposed dikes. The character of the rock worked is somewhat similar to that of the Amador Queen—alternations of gray slates, small veins, and a decomposed crystalline rock. The whole of the rock is filled with stringers of quartz and the greater part of it is milled. The gouge on the footwall of the main vein of the Zeile varies from a few feet to fifty feet. There is no gouge on the hanging wall, and the horse is always from that wall. The best paying portion is the ribbon quartz."

According to Folio 63 of the U. S. Geological Survey,

> "The vein is essentially a stringer lead in amphibolite schist and has a general dip of 50° to 60° E. It is separated from the black slates (Calaveras formation) of the footwall by a heavy gouge. The width of the vein where stoped is 40 to 50 feet, but the general average is somewhat less. A fine-grained, altered dike, from 4 to 6 feet wide, probably originally a diorite, accompanies the vein. The ore is of low grade—less than $4 per ton. Pyrite is the principal sulphide, but there is sometimes a little molybdenite, and small quantities of galena and zincblende are said to occur and to indicate good ore. Calcite is quite abundant, both as stringers and crystallized with the quartz."

The shaft was sunk 1700 ft. on an incline of 65°. The 1570-ft. level drift was run north 3000 ft., and on that end a winze was sunk 458 ft., with levels at 157 and 295 ft., which were also drifted north, the latter 450 ft. At the time of closing it was stated the mine contained 360,000 tons of ore averaging less than $4 a ton. It was stoped out from the 1200-ft. level to the surface, north of the shaft, where the ore-shoot was 600 ft. long and averaged 20 ft. wide.

The mill of 40 stamps in the most productive years crushed from 60,000 to 65,000 tons of ore annually with an annual output that only once exceeded $200,000. The concentrate formed from 2% to 2.3% of ore, and yielded from $68 to $93 a ton. This concentrate carried from one-half to over two-thirds of the gold, and was treated by chlorination at the property.

## TABLE OF QUARTZ MINES AND PROSPECTS ON THE MOTHER LODE BELT, AMADOR COUNTY

| Name of mine | Location | | | To whom assessed | Elevation, feet | Area, acres | Bibliography |
|---|---|---|---|---|---|---|---|
| | Sec. | Twp. | Range | | | | |
| A. and B | 14, 13<br>11 | 7 N.<br>7 N. | 10 E.<br>10 E. | Mrs. Maggie Reaves, 1316 Eighteenth St., Sacramento; John C. Reaves, Plymouth, agent | 1,050 | 13 | XIV, p. 14. |
| Aetna | | | | | | | (See Amador Gold). |
| Alphi | 34, 35 | 6 N. | 11 E. | W. H. Taylor, Jackson | | 19 | |
| Alpine | 2 | 7 N. | 10 E. | Alpine Mining Co., Box 43, Menlo Park | 1,100 | 12 | XIII, p. 67; XIV, p. 15. |
| Amador Cons | | | | | | | (See Old Eureka). |
| Amador Gold and Amador Queen No. 1, Aetna et al. | 34, 35<br>3 | 6 N.<br>5 N. | 11 E.<br>11 E. | W. J. McGee, Jackson | 1,000 | 117 | IX, pp. 88-93; X, pp. 102-103; XII, p. 71; XIII, p. 72; XIV, p. 15; Bull. 18, p. 44. |
| Amador King | 23 | 8 N. | 10 E. | (See Amador Star) | 900 | 407 | XIV, p. 15; Bull. 18, p. 86. |
| Amador Queen No. 2 | 34<br>3 | 6 N.<br>5 N. | 11 E.<br>11 E. | W. J. McGee, Jackson | 1,000 | 50 | VII, pp. 91-93; X, p. 107; XII, p. 71; XIV, p. 16; Bull. 18, p. 44. |
| Amador Star | 23 | 8 N. | 10 E. | Henry Kaiser, 1443 S. San Joaquin St., Stockton | | 130 | |
| Anita | 28 | 6 N. | 11 E. | Anita Mining Co., 407 Montgomery St., San Francisco | 1,150 | 44 | XIII, p. 68; XIV, p. 16. |
| Argonaut | 17, 20<br>21 | 6 N.<br>6 N. | 11 E.<br>11 E. | Argonaut Mining Co., 404 Humboldt Bank Bldg., San Francisco. | 1,550 | 78 | XIII, p. 68; XIV, pp. 17-19; XVII, pp. 406-408; XVIII, p. 298; XIX, pp. 13-14; XX, pp. 2, 177; Pre. Rep. 8, pp. 23-24; Bull. 18, pp. 50-52. |
| Atlantic | 13, 24 | 7 N. | 10 E. | Est. of W. F. Detert, Mills Tower, San Francisco, c/o R. Detert | | 15 | |
| Badger | | | | | | | (See Old Eureka). |
| Ballard & Martin | 14 | 8 N. | 10 E. | Mrs. Maria Ballard, 1917 Baker St., San Francisco | 1,000 | 160 | |
| Bay State | 23 | 8 N. | 10 E. | Stockton Savings Bank, Stockton, Lovaggi Est. Co., Plymouth, agents | 1,000 | 80 | XI, p. 146; XII, p. 71; XIII, p. 69; XIV, pp. 19-20; Bull. 18, pp. 85-86. |
| Bellwether | 21 | 6 N. | 11 E. | (Now part of Kennedy Mine) | 1,180 | | X, pp. 104-105; XI, p. 141; XII, p. 71; XIII, p. 69. |
| Blue Jacket | 28 | 6 N. | 11 E. | Kennedy M. & M. Co., 409 Montgomery St., San Francisco | | | |
| Boro | 24 | 7 N. | 10 E. | Charles Boro, Drytown | | | |
| Bona Fortuna | 25 | 7 N. | 10 E. | Dr. Thos. Boydson's Estate, Plymouth, ½; Fremont Mining Co., ½ | | 20 | |
| Bright | 28 | 6 N. | 11 E. | Anita G. Mining Co., Jackson | | 45 | |
| Brown | | | | | | | (See Jose Gulch). |
| Bruce | 14 | 7 N. | 10 E. | Estate of P. B. Cornwall, 128 Sutter St., San Francisco, c/o Colwell, Cornwall and Banker | | 17 | |
| Bryan | 23 | 8 N. | 10 E. | | | | |
| Bunker Hill, Mayflower and Nevada | 25, 36 | 7 N. | 10 E. | Bunker Hill Cons. Mg. Co., O. D. Roblfs, Secy., 1908 Hobart Bldg., San Francisco | | 76 | VIII, pp. 57-63; X, p. 75; XI, p. 79; XII, p. 79; XIII, p. 77; XIV, pp. 20-21; XVII, pp. 408-409; XVIII, pp. 298-299; XIX, pp. 2, 15; XX, p. 2; Pre. Rep. 8, p. 24. |
| Burlington | 4 | 6 N. | 11 E. | Dr. Espy L. Smith, c/o Illinois Merch. Trust Co., 3122 Washington Blvd., Chicago, Illinois | | 150 | |

TABLE OF QUARTZ MINES AND PROSPECTS ON THE MOTHER LODE BELT, AMADOR COUNTY—Continued

| Name of mine | Location | | | To whom assessed | Elevation, feet | Area, acres | Bibliography |
|---|---|---|---|---|---|---|---|
| | Sec. | Twp. | Range | | | | |
| California | 24 | 7 N. | 10 E. | Estate of W. F. Detert, Mills Tower, San Francisco, c/o R. Detert | | 11 | |
| Casco | | | | | | | (See Hardenberg). |
| Caucasian Cons. | 23 | 8 N. | 10 E. | Wm. J. McGee, Sutter Creek | | | X, p. 120. |
| Centennial | 13 | 7 N. | 10 E. | | | | Bull. 18, p. 82. |
| Central Eureka (including Old Eureka) | 7, 8 | 6 N. | 11 E. | Central Eureka Mining Co., 519 California St., San Francisco | | 182 | VIII, p. 49; X, p. 104; XI, p. 144; XII, p. 79; XIII, pp. 69-70; XIV, p. 24; XVII, pp. 409-410; XVIII, p. 299; XIX, p. 2, 15; XX, p. 2; Bull. 18, pp. 64-65; Pre. Rep. 8, p. 24. |
| Chili Jim | 24 | 7 N. | 10 E. | Estate of W. F. Detert, Mills Tower, San Francisco, 3/5; P. B. Cornwall Estate, 2/5 | | | |
| Clyde | 17, 20 | 6 N. | 11 E. | (Now part of Kennedy) | | | X, pp. 110-111. |
| Clyde No. Ext. | 17 | 6 N. | 11 E. | (Now part of Kennedy) | | | |
| Comet | 6 | 6 N. | 11 E. | Mary Baumhardt and Helen Agen, c/o Mrs. H. Agen, R.F.D. C-152-A, Modesto | 1,200 | 7 | X, p. 114; XIV, p. 26. |
| Cons. McNamara | 3 | 5 N. | 11 E. | Mother Lode Mining Co., c/o L. Newman, 272 O'Farrell St., San Francisco | | | |
| Cosmopolitan, Dry Creek, Henry Clay | 14 | 7 N. | 10 E. | Estate of W. F. Detert, c/o R. Detert, Mills Tower, San Francisco | 900 | 100 | Field report. |
| Crannis | 10 | 5 N. | 11 E. | Chas. A. McKinney, Jackson | | 9 | |
| Creek Ledge | 35 | 8 N. | 10 E. | Webb Smith, Jackson, et al | 1,000 | 160 | XIV, p. 27. |
| Croesus and St. Martin | 26 | 8 N. | 10 E. | Estate of Martin Snable, c/o Levaggi Estate Co. Plymouth | | 39 | |
| Crown | | | | | | | (See Jose Gulch). |
| De Silvia | 20 | 6 N. | 11 E. | | | | (Part of Kennedy M. & M. Co.). |
| Dewitt | 3 | 5 N. | 11 E. | Dr. W. M. Bar Due, San Francisco | | | |
| Dewitt Quartz | 3 | 5 N. | 11 E. | Dr. W. M. Bar Due, San Francisco | | | |
| Dowling | 27, 28 | 6 N. | 11 E. | South Jackson Mining Co., Jackson | | 8 | Also 60.7a, adjoining. |
| Doyle | 34 | 6 N. | 11 E. | Mrs. Catherine Doyle, Jackson | 975 | 18 | X, p. 107; XII, p. 72; XIII, p. 70; XIV, p. 27. |
| Dry Creek | 13, 14 | 7 N. | 10 E. | Estate of W. F. Detert, c/o R. Detert, Mills Tower, San Francisco | | 5 | |
| East Keystone | | | | | | | (See Keystone). |
| Easton | | | | | | | (See Shenandoah). |
| Eclipse | 36 | 7 N. | 10 E. | (Now Original Amador) | | | X, p. 114. |
| El Dorado | 36 | 7 N. | 10 E. | T. C. Mayon, 1531 Market St., Oakland, et al | 900 | 13 | X, p. 99; XIV, p. 27. |
| | 31 | 7 N. | 11 E. | | | | |
| Elephantine | | | | | | | (See Middle Bar Group). |
| Empire | | | | | | | (See Plymouth). |
| Empire | 3 | 5 N. | 11 E. | Dr. W. M. Bar Due, San Francisco | | | |
| Eureka | 7, 8 | 6 N. | 11 E. | Central Eureka Mng. Co., 519 California St., San Francisco | 1,200 | | X, p. 72; XIII, p. 67; XIV, p. 28; (See Old Eureka). |

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|---|---|---|---|---|---|---|---|
| Eureka No. 2 | 25 | 7 N. | 10 E. | Estate of W. F. Detert, c/o R. Detert, Mills Tower, San Francisco | | | |
| Evans | 28 | 6 N. | 11 E. | | | | XII, p. 78; XIII, p. 70. |
| Excelsior | 23 | 8 N. | 10 E. | Gertrude V. Clark, Sutter Creek | | 20 | |
| Extension | 11 | 7 N. | 10 E. | L. L. Rich, 136 Liberty St., New York, et al. | | 17 | |
| Farrell | 15 | 5 N. | 11 E. | Estate of Rose Rosenberg, c/o Joe Rosenberg, 215 Bacon Bldg., Oakland | 600 | 9 | X, pp. 107-108; XII, p. 72; XIII, p. 70; XIV, p. 288. |
| Fort John | 11 | 7 N. | 10 E. | E. Rose, c/o E. S. McCurdy, 575 Mills Bldg., San Francisco | | | |
| Forty-Nine | 14 | 7 N. | 10 E. | E. S. Barney, Hayward | | 19 | X, p. 122. |
| Fremont | 25 | 7 N. | 10 E. | Fremont Cons. Mining Co., 2216 Russ Bldg., San Francisco | 1,000 | 150 | VIII, p. 53; X, p. 75; XI, p. 146; XII, p. 72; XIII, p. 71; XIV, pp. 28-29; XVII, p. 411; XVIII, p. 299; XIX, pp. 15, 73, 143; XX, p. 2; Pre. Rep. 8, p. 24; Bull. 18, pp. 80 81. |
| Giant | 11 | 7 N. | 10 E. | (Part of Plymouth) | | | |
| Golden Eagle, Triumph | 6 | 6 N. | 11 E. | C. R. Downs, Sutter Creek | | | X, pp. 113-114. |
| Golden Gate | 14 | 7 N. | 10 E. | Estate of John F. Davis, Humboldt Bank Bldg., San Francisco | | 20 | |
| Golden Gate | 14 | 8 N. | 10 E. | Chas. Kretcher, R.F.D. 1, box 36, Placerville, ½; Est. of W. F. Detert, c/o R. Detert, Mills Tower, San Francisco, ½ | | 17 | |
| Golden Gate | 20 | 6 N. | 11 E. | (Part of Kennedy M. & M. Co.) | | | |
| Good Hope | 28 | 6 N. | 11 E. | C. P. Vicini, Jackson, et al., Good Hope Mining Co., c/o J. F. Davis, Humboldt Bank Bldg., San Francisco | 1,100 | 40 | XIII, p. 71; XIV, p. 29. |
| Gover | 25 | 7 N. | 10 E. | Fremont Cons. Mng. Co., 2216 Russ Bldg., San Francisco | | | VIII, pp. 53-57; X, p. 75; XI, p. 146; XII, pp. 72-74; XIII, p. 71. |
| Great Eastern | 23 | 8 N. | 10 E. | Great Eastern Mng. Co., c/o Elmer Tripp, Plymouth | | 14 | |
| Grey Eagle | 2 | 7 N. | 10 E. | O. Ball, Plymouth | | 8 | |
| Haley (De Witt No. 1 & No. 2) | 34 | 6 N. | 11 E. | Gustave Baumann, c/o L. Everett, Mokelumne Hill | | | |
| Haley Quartz | 24 | 6 N. | 11 E. | | | | |
| Hardenburg | 10 | 5 N. | 11 E. | Wm. J. and Ralph McGee | 825 | 45 | X, pp. 68, 106-107; XI, pp. 139-140; XII, p. 74; XIII, p. 71; XIV, pp. 29-30. |
| | 3 | 6 N. | 11 E. | | | | |
| Hartford | 2 | 7 N. | 10 E. | | | | |
| Hazard | | | | | | | (See Treasure). |
| Hector | | | | Part of Lincoln Cons. | | | VIII, p. 73; XI, p. 145. |
| Hercules | 14 | 7 N. | 10 E. | Estate of W. F. Detert, c/o R. Detert, Mills Tower, San Francisco | | 16 | |
| Herbertville (Talisman) | 31 | 7 N. | 11 E. | Keystone Mining Company, Amador City | | | |
| Idaho, Jr. | | | | | | | (See Excelsior). |
| Illinois, Green, et al. | 35 | 8 N. | 10 E. | Estate of Dr. T. Boydsor, Plymouth | | 48 | X, p. 119. |
| Indiana | 11 | 7 N. | 10 E. | Argonaut Mng. Co., 404 Humboldt Bank Bldg., San Francisco | | | (Part of Plymouth). |
| Italian | 24 | 7 N. | 10 E. | Ginocchio Brothers, Jackson | | 2 | X, pp. 115-116. |
| Jackson | 20 | 6 N. | 11 E. | | | | |
| Jackson Gate | | | | | | | XIII, pp. 71-72. |
| Jackson, G. M. & M. Co. | Lot 39 | Bl'k. 10 | Jackson | c/o A. Peters, Angels Camp | | | |
| Joe Davis | 13, 14 | 7 N. | 10 E. | Estate of W. F. Detert, c/o R. Detert, Mills Tower, San Francisco | | 8 | |

TABLE OF QUARTZ MINES AND PROSPECTS ON THE MOTHER LODE BELT, AMADOR COUNTY—Continued

| Name of mine | Location | | | To whom assessed | Elevation, feet | Area, acres | Bibliography |
|---|---|---|---|---|---|---|---|
| | Sec. | Twp. | Range | | | | |
| Kelly | 3 | 5 N. | 11 E. | C. P. Vicini, Jackson | 850 | 40 | X, p. 108; XII, p. 74; XIII, p. 72; XIV, p. 30 |
| Kennedy | 16, 17 20, 21 | 6 N. 6 N. | 11 E. 11 E. | Kennedy Mining and Milling Co., 409 Montgomery St., San Francisco | 1,500 | 156 | VIII, pp. 66-71; X, pp. 103-104; XI, pp. 141-142; XII, pp. 74, 77; XIII, p. 72; XIV, pp. 31-34; XVII, p. 408; XVIII, p. 299; XIX, p. 15; XX, pp. 2-3; 177; Bull. 18, pp. 52, 60. |
| Keystone | 36 | 7 N. | 10 E. | Keystone Mining Co., c/o C. L. Culbert, Secy., Jackson | 1,100 | 123 | VI, pt. 2, pp. 16-17; VIII, pp. 63-66; X, pp. 98, 72, 73; XI, p. 145; XII, p. 77; XIII, p. 72; XIV, pp. 34-35; XVII, p. 411; Bull. 18, p. 77. |
| Kruger & Vaughn (Lots 55 & 59) | 3 | 5 N. | 11 E. | F. and J. Champion, 468 Rich St., Oakland | | 40 | X, p. 107. |
| Lady Bedford | 14 | 8 N. | 10 E. | E. Steel, ½, c/o G. M. Steel, Lodi; ½ to Williams Strange & Smith. 309 S. School St., Lodi | | 14 | |
| Last Chance | 36 | 7 N. | 10 E. | J. W. Bullock, Seattle, Wash. (Cons. with Original Amador) | 1,200 | | X, p. 115. |
| Law Lottier | 34 | 6 N. | 11 E. | | | | |
| Lincoln Cons | 6, 7, 8 | 6 N. | 11 E. | Lincoln Cons. Mining Co., Sutter Creek | 1,200 | 380 | VIII, p. 73, 75-79; IX, pp. 73, 75-78; X, pp. 100, 101-102; XI, p. 144; XII, pp. 79-80; XIII, pp. 73-74; 78-79; XIV, pp. 36-37. |
| Little Amador | 36 | 7 N. | 10 E. | (See Original Amador) | | | XIII, pp. 72-73. |
| Littlefield | | | | | | | (New Albany Cons). |
| Little Illinois | 23 | 7 N. | 10 E. | J. H. Thomas Estate, Drytown | 800 | 36 | XIV, p. 37. |
| Little Sargent | 10 | 5 N. | 11 E. | Estate of A. Caminetti, Jackson | | | |
| Loyal (or Loyal Lode) | | | | (Now part of Fremont Mine) | | | VIII pp. 51-53; XIII, p. 73. |
| Lucille | | | | Argonaut Mng. Co., 404 Humboldt Bank Bldg., San Francisco | | | VIII, pp. 49-51; X, pp. 117-118; XII, p. 78; XIV, p. 37; XIII, p. 73. |
| Mahoney | | | | (Part of Lincoln Cons) | | | VIII, p. 73; X, p. 72; XII, p. 78; Bull. 18, pp. 65-71. |
| Mammoth | 10 | 5 N. | 11 E. | F. W. Patterson Estate, Fresno; Alex Chalmers, Angels, agent; Federal Dev. Co., c/o S. L. Jones, 176 Townsend St., San Francisco | 650 | 26 | VI, pt. 2, pp. 21-22; VIII, pp. 93-94; X, p. 119; XI, p. 67; XII, p. 78; XIII, p. 74; XIV, p. 38; XIX, p. 143. |
| Marlette | | | | | | | (See Sargent). |
| Maryland | 24 | 7 N. | 10 E. | Estate of P. B. Cornwall, 128 Sutter St., San Francisco | | 13 | |
| Massa | | | | | | | (See Jackson Gate). |
| Maxwell | 7 | 6 N. | 11 E. | Central Eureka Mining Co., 519 California St., San Francisco | | | (Part of Old Eureka). |
| May Ella | 11 | 7 N. | 10 E. | C. H. Shields and S. Wilds, Plymouth | | 18 | |
| Mayflower | | | | (See Bunker Hill) | | | XII, p. 78; XIII, p. 74. |
| McIntyre | 6 | 6 N. | 11 E. | Estate of John A. McIntyre, 1530 O St., Sacramento | 1,100 | 24 | X, p. 115; XIII, p. 74; XIV, p. 38. |
| McKinney and Crannis | 10, 15 | 5 N. | 11 E. | G. A. McKinney, Jackson | | | X, p. 106. |
| McKay & Love | 3 | 5 N. | 11 E. | | | | (See Amador Gold). |

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|---|---|---|---|---|---|---|---|
| Mechanics | 4, 5<br>32, 33 | 6 N.<br>7 N. | 11 E.<br>11 E. | Wm. J. McGee and Trustees, Sutter Creek | | 14 | X, p. 112; XIII, p. 74; XIV, p. 38; Bull. 18, p. 76. |
| Medcan | | | | Keystone Mining Company | | | (See South Spring Hill). |
| Mechan Cons. | 10 | 5 N. | 11 E. | W. Gibbert, J. Strohm, M. C. Fontenrose, Jackson | | 24 | |
| Meck | 28 | 6 N. | 11 E. | | | | (See Evans). |
| Middle Bar | | | | | | | (See New Albany Cons.). |
| Middle Bar Q. M. | 10 | 5 N. | 11 E. | Mrs. J. and G. Turcinovich et al., Jackson | | | |
| Middle Bar Group | 3, 10<br>15 | 5 N.<br>5 N. | 11 E.<br>11 E | Mrs. Lena Glavinich and M. Thomas | 700 | 80 | X, pp. 108-109; XIV, p. 38 |
| Mineral Point | 3 | 5 N. | 11 E. | H. E. Furman, Sutter Creek, et al. | | 9 | |
| Monte de Oro | 26, 35 | 8 N. | 10 E. | c/o Levaggi Estate Co., Plymouth | 1,000 | 147 | XIV, p. 38. |
| Montezuma | 11 | 7 N. | 10 E. | | | | |
| Monitor | 14 | 7 N. | 10 E. | Charles H. Shields, Plymouth | | 7 | |
| Moore | 34, 33 | 6 N. | 11 E. | Moore Mining Co., San Francisco; Central Land Co., c/o Alex Chalmers, agent, cor. Park Way and Monte Ave., Piedmont | 1,125 | 200 | VI, pt. 2, p. 20; VIII, pp. 84-85; XII, p. 78; XIII, p. 74; XIV, p. 38; XVIII, pp. 299-300; XIX, pp. 15-16; XX, pp. 3, 74, 177; Pre. Rep. 8, p. 24. |
| Morley | | | | | | | (See Middle Bar Group). |
| Muldoon | 20 | 6 N. | 11 E. | Argonaut Mining Co., 404 Humboldt Bank Bldg., San Francisco | | | |
| Murray, Vaughn, Kruger | | | | (See Kruger) | | | X, p. 107. |
| Mutual | 6 | 6 N. | 11 E. | | 1,300 | | Bull. 18, pp. 74-75. |
| Nevill | | | | | | | (See Mammoth Mine). |
| New Albany | 10, 15 | 5 N. | 11 E. | New Albany Cons. Gold Mining Co., Martin Jones, San Francisco, agent | 600 | 100 | XII, p. 78; XIII, pp. 74-75; XIV, p. 39. |
| New London | 11, 14 | 7 N. | 10 E. | Estate of W. F. Detert, c/o R. Detert, Mills Tower, San Francisco, 1/3; Argonaut Mining Co., 404 Humboldt Bank Bldg., San Francisco, 2/3 | | 18 | (See Lucille). |
| Niagara | 36 | 7 N. | 10 E. | Keystone Mines Corporation, Amador City | | | |
| North California | 23 | 7 N. | 10 E. | Estate of W. F. Detert, c/o R. Detert, Mills Tower, San Francisco | | 7 | |
| North Eureka, No. 2 | 14 | 7 N. | 10 E. | Estate of W. F. Detert, c/o R. Detert, Mills Tower, San Francisco | | 4 | |
| North Henry Clay | 14 | 7 N. | 10 E. | Estate of W. F. Detert, c/o R. Detert, Mills Tower, San Francisco | | 12 | |
| North Gover | 25 | 7 N. | 10 E. | (Part of Fremont Mine) | | | X, pp. 116-117; XIII, p. 75. |
| North Star | 6 | 6 N. | 11 E. | South Keystone Mining Co., c/o Wm. Fergis, Tacoma | 1,300 | 8 | VIII, pp. 71-72; X, p. 99; XII, p. 78; XIII, p. 75; XIV, p. 39. |
| Oaks | 11 | 7 N. | 10 E. | Argonaut Mining Co., Humboldt Bank Bldg., San Francisco | | | (Part of Plymouth). |
| No. 1 and No. 2 | 5, 8 | 6 N. | 11 E. | L. R. Poundstone, Grimes | | 38 | |
| Old Eureka, Tanner Tunnel, Alpha Mining Company | 8 | 6 N. | 11 E. | Central Eureka Mining Co. | 1,200 | 111 | X, pp. 72, 102; 113; XI, p. 144; XIII, p. 67; XIV, p. 28; XVII, p. 411; XIX, p. 73; XX, pp. 3, 74; Pre. Rep. 8, p. 24. |
| Old Oaker | 4 | 7 N. | 10 E. | Southerland and Southerland, c/o H. Hurd, 1st National Bank Bldg., Roswell, New Mexico | | 17 | |
| Oneida | 17 | 6 N. | 11 E. | South Eureka Mng. and Milling Co., 2013 Russ Bldg., San Francisco | 1,300 | 283 | VIII, p. 79; X, pp. 109-110; XII, p. 78; XIII, p. 75; XIV, p. 39; Bull. 18, pp. 60-63. |

TABLE OF QUARTZ MINES AND PROSPECTS ON THE MOTHER LODE BELT, AMADOR COUNTY—Continued

| Name of mine | Location | | | To whom assessed | Elevation, feet | Area, acres | Bibliography |
|---|---|---|---|---|---|---|---|
| | Sec. | Twp. | Range | | | | |
| Oneta | 15 | 5 N. | 11 E. | | | | |
| Original Amador | 36 | 7 N. | 10 E. | J. W. Bullock, Seattle, Washington | 1,050 | | VIII, p. 42; X, p. 114; XII, p. 78; XIV, pp. 39-40; XX, p. 3. |
| Osceola | 14 | 8 N. | 10 E. | Osceola Mining Co., c/o Furi and Co., 521 Clay St., San Francisco | | 120 | |
| Pacific | | | | | | | (See Plymouth Cons.). |
| Peerless, Coulter, Homestake | 24 | 7 N. | 10 E. | Seaton Mng. Co., c/o H. A. Myers, Plymouth | | 9 | (See Seaton). |
| Philadelphia | 14 | 8 N. | 10 E. | J. J. Crawford, Humboldt Bank Bldg., San Francisco, et al. | 1,000 | 140 | XII, p. 78; XIII, p. 75; XIV, p. 41; Bull. 18, p. 84. |
| Phoenix East | 2 | 7 N. | 10 E. | Argonaut Mng. Co., Humboldt Bank Bldg., San Francisco | | | (Part of Plymouth). |
| Pioneer | 14 | 7 N. | 10 E. | Est. of Dr. Thomas Boydson, Plymouth | 1,100 | 20 | VIII, p. 42; X, p. 112; XII, pp. 78-79; XIII, p. 75; XIV, p. 41; Bull. 18, pp. 83-84. |
| Pioneer | | | | | | | (See Argonaut). |
| Plymouth Cons. | 11 | 7 N. | 10 E. | Argonaut Mng. Co., Humboldt Bank Bldg., San Francisco | 1,100 | 156 | VI, pt. 2, pp. 15-16; VIII, pp. 42-49; X, p. 117; XI, p. 79; XII, p. 79; XIII, p. 75; XIV, pp. 37, 41-43; XVII, p. 411; XVIII, p. 301; XIX, pp. 16, 73; XX, pp. 3, 177; Pre. Rep. 8, p. 24; Bull. 18, pp. 82 83. |
| Plymouth-Eureka | 3 | 7 N. | 10 E. | c/o J. Ninis, Plymouth | 1,050 | 40 | XIV, p. 43. |
| Plymouth Rock | 10 | 7 N. | 10 E. | Isaac W, Winans, Plymouth | | 20 | |
| Pocahontas | 23, 24 | 7 N. | 10 E. | Estate of W. F. Detert, c/o R. Detert, Mills Tower, San Francisco, 3/5, and Allen McWayne Drytown, 2/5 | 900 | 10 | X, pp. 122-123; XIV, p. 44; Bull. 18, p. 83. |
| Poclepovich | 24 | 7 N. | 10 E. | | | | |
| Prize | 26 | 8 N. | 10 E. | J. H. Durst and C. C. Castle, also assessed to W. L. Phillips, West Point | | 20 | X, pp. 120-121. |
| Providence | 14 | 7 N. | 10 E. | Estate of W. F. Detert, c/o R. Detert, Mills Tower, San Francisco | | 16 | |
| Railroad | 7 | 6 N. | 11 E. | Central Eureka Mng. Co., 519 California St., San Francisco | | | (Part of Old Eureka). |
| Red Cloud | 33 | 8 N. | 10 E. | Glanch Bros., Oleta, et al. and A. Perovich, Jackson | | | X, pp. 119-120; XIII, pp. 75-76; XIV, p. 45; Bull. 18, p. 85. |
| Red Crown | 34 | 6 N. | 11 E. | Estate of Wm. Moon, Jackson | | | |
| Red Oak | 11 | 7 N. | 10 E. | | | 20 | X, p. 121. |
| Reese & Woolford | 11 | 7 N. | 10 E. | Argonaut Mng. Co., Humboldt Bank Bldg., San Francisco | | | (Part of Plymouth). |
| Reeves | 14 | 7 N. | 10 E. | | | | (See A & B Mine). |
| Rhetta | | | | | | | (See Amador Star). |
| Richmond | | | | | | | (See Philadelphia). |
| Sargent and Marlette | 10 | 5 N. | 11 E. | Mrs. Julia Sargent, Jackson | 650 | 193 | X, p. 107; XIV, p. 45. |
| Seaton | 24 | 7 N. | 10 E. | Seaton Mining Co., c/o H. A. Myers, Plymouth | 1,000 | 20 | VIII, p. 42; XIII, p. 78; XIV, p. 45. |
| Shakespeare | 14 | 7 N. | 10 E. | | | | X, pp. 121-122. |
| Sierra | 20 | 6 N. | 11 E. | | | | |

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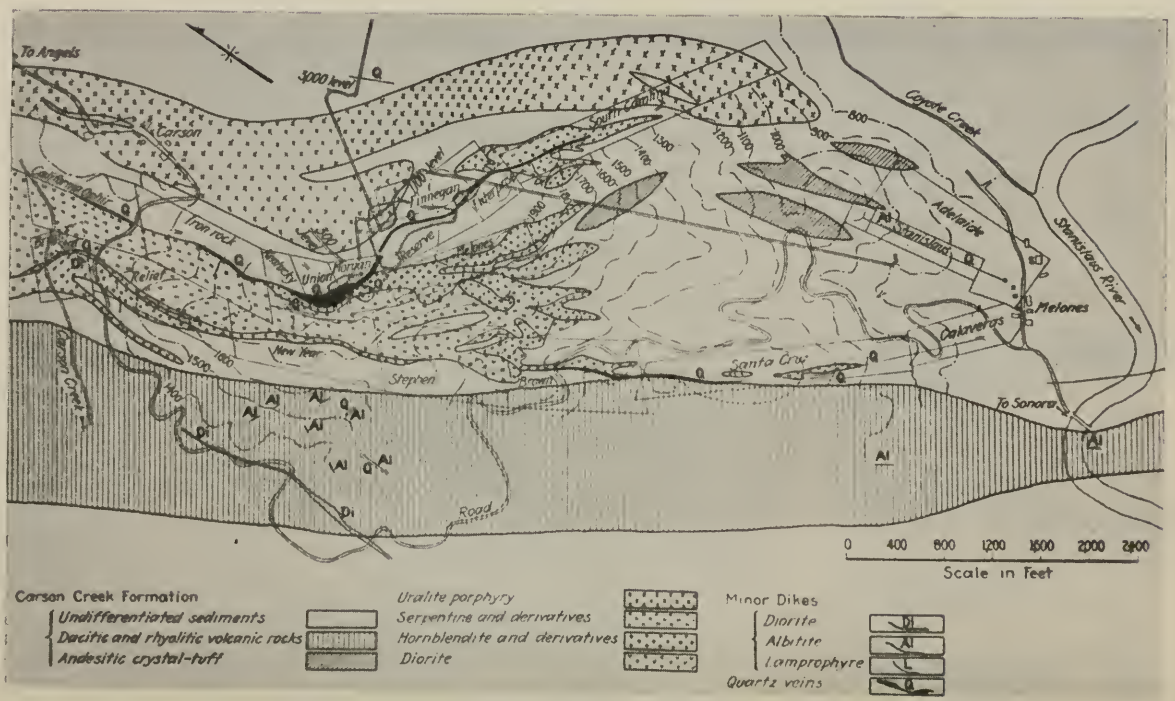
|---|---|---|---|---|---|---|---|
| Simpson & Aden | 11 | 7 N. | 10 E. | Argonaut Mng. Co., Humboldt Bank Bldg., San Francisco | | | (Part of Plymouth Cons.). |
| South Cosmopolitan | 24 | 7 N. | 10 E. | Estate of W. F. Detert, c/o R. Detert, Mills Tower, San Francisco | 925 | 14 | VIII, p. 49. |
| Southerland | 11 | 7 N. | 10 E. | Argonaut Mng. Co., Humboldt Bank Bldg., San Francisco | | | (Part of Plymouth). |
| South Eureka | 17, 8 | 6 N. | 11 E. | South Eureka Mng. Co., 2013 Russ Bldg., San Francisco | 1,700 | 431 | X, p. 113; XI, p. 144; XII, p. 79; XIII, pp. 76-77; XIV, pp. 45-47; Bull. 18, pp. 63-64. |
| South Jackson | 28, 34 | 6 N. | 11 E. | South Jackson Mng. Co., Jackson; J. Schweitzer, Secy., 3600 Clay St., San Francisco | 1,400 | 70 | XIV, pp. 47-48. |
| South Keystone | 6 | 6 N. | 11 E. | Mrs. B. C. Clark, Sutter Creek, ¾; Estate of J. A. McIntyre, 1530 O St., Sacramento, ¼ | | | X, p. 115; Bull. 18, p. 77. |
| South Mahoney | 6 | 6 N. | 11 E. | | | | (Part of Lincoln Gold Mining Co.). |
| South Mayflower | | | | | | | (See Bunker Hill). |
| South Spring Hill (including Medean and Talisman) | 31 | 7 N. | 11 E. | Keystone Mining Co., c/o C. L. Culbert, Secy., Jackson | 1,100 | 38 | VI, p. 18; VIII, p. 71; 80-84; X, pp. 73, 98, 99; XI, p. 145; XII, p. 79; XIII, pp. 74, 77; XIV, p. 48; Bull. 18, p. 77. |
| Stewart | | | | (Now part of Lincoln Cons.) | | | VI, p. 19; XII, p. 79. |
| St. Julian | 10 | 5 N. | 11 E. | Bank of Amador County, Jackson | 900 | 12 | XIII, p. 77; XIV, p. 48. |
| Stribley | 28 | 6 N. | 11 E. | | | | |
| Summit | | | | Central Eureka Mining Co., 519 California St., San Francisco | | | (See Central Eureka). |
| Sutter Creek | | | | | | | (See Belmont). |
| Talisman | | | | Keystone Mining Co., c/o C. L. Culbert, Secy., Jackson | | | (See South Spring Hill). |
| Treasure | 25 | 7 N. | 10 E. | Treasure Mining Co., Mills Bldg., San Francisco; E. S. McCurdy, Secy. | 1,000 | 22 | XIII, pp. 77-78; XIV, pp. 49-50; XVII, pp. 411-412; XVIII, p. 300; XIX, p. 16. |
| Udy | 21 | 6 N. | 11 E. | | | | |
| Valparaiso | 10 | 5 N. | 11 E. | D. Boro, E. Garibaldi, Jackson, et al., Valparaiso Mining Co., Jackson | 980 | 36 | VIII, p. 42; XII, p. 79; XIII, p. 78; XIV, p. 52. |
| Venture Gold | 23 | 8 N. | 10 E. | | | | |
| Victoria | 11, 24 | 7 N. | 10 E. | John Dixon, c/o R. D. Dixon, 425 Fourth St., Santa Rosa | | 20 | |
| Volunteer | 20 | 6 N. | 11 E. | Argonaut Mining Co., Jackson | | 15 | X, p. 105. |
| Wabash | 6 | 6 N. | 11 E. | Wabash Mining Co., c/o Webb Smith, Jackson | | | |
| West Eureka | 7 | 6 N. | 11 E. | John Ross, E. D. Botta, Sutter Creek, et al. | 1,220 | 15 | XIV, p. 52. |
| Wetzler | | | | | | | (See Middle Bar Group). |
| Wheeler | 2 | 7 N. | 10 E. | | | | (See Alpine). |
| White Mountain | 19 | 7 N. | 12 E. | J. P. Treanor, 454 California St., San Francisco | | 15 | |
| Wildman | | | | (Part of Lincoln Consolidated) | | | VIII, p. 75; X, p. 101; XI, p. 144; XII, p. 80; Bull. 18, pp. 65-71. |
| Worley | 24 | 7 N. | 10 E. | | | | (See South Cosmopolitan). |
| Wyomea | 2 | 7 N. | 10 E. | | | | X, p. 118. |
| | 35 | 8 N. | 10 E. | | | | |
| Zeile (Zcila) | 28 | 6 N. | 11 E. | Kennedy Mining and Milling Co., Clunie Bldg., San Francisco | 1,400 | 260 | VI, pp. 22-23; VIII, pp. 22, 68, 85, 88; X, pp. 68, 104; XI, p. 139; XII, p. 80; XIII, p. 79; XIV, p. 52; Bull. 18, pp. 45, 50. |




Generalized geological map of Carson Hill, Calaveras County. Reproduced from Engineering and Mining Journal, Vol. 124, No. 26. Geology by Frank A. Moss.

## CALAVERAS COUNTY

### Geology.

The most productive sections of the Mother Lode in this county are the ones extending from Stanislaus River to the north slope of Carson Hill, and that within the townsite of Angels Camp. In the first, the ores occur in or near altered intrusives occupying contact areas between the amphibolite schist and the Calaveras formation. At Angels Camp the mines were found in profoundly altered and silicified amphibolite schists. (See Utica and Gold Cliff Mines.) The more important mines of Angels Camp were all in a block of country bounded on the north by a fault crossing the course of the lode and dipping southeast. West and northwest of Angels Camp, mineralization occurs over a width of more than two miles, in which many small mines but no large orebodies have yet been found. Characteristic of this zone are 'stringer leads' of quartz and calcite, with occasional pockets, in amphibolite schist. A few miles northwest of Altaville, there is a group of small mines in the Calaveras slates which show well-defined veins. Among these are the Shotgun, Demarest and Thorne. From Altaville to the vicinity of San Andreas mines and prospects are scattered along a northwestward course in amphibolite schist. It is not until the Gwin Mine is reached, near the northern end of the county, that the lode re-enters the Mariposa clay slate. This mine is on the extreme west side of the slate belt, in a lens of slate about one-quarter of a mile wide, with altered andesite on both sides, and is similar geologically to the important mines at Jackson and Sutter Creek.

Mokelumne Hill district, which is at the southeast end of a batholith of diorite with an area of about six square miles, is east of the course of the Mother Lode, but has many quartz mines, some of which have been important producers.

### Geography, climate, water, power, timber.

Calaveras shares with the counties north and south a gently rolling topography in the Mother Lode section. There are no important streams crossing the lode between the north and south county-lines, which are formed by the Mokelumne and Stanislaus Rivers respectively. Occupying as they do, deep canyons which they have cut transversely across the course of the Sierra Nevada's western slope, they have necessitated expensive installations for water and hydroelectric power supply. Carson Hill, the principal outstanding topographic feature of the lode in this county, rises to an elevation of about 1900 feet, over 1100 feet higher than Stanislaus River which flows by it on the south. This hill and Chaparral Hill owe their heights to the resistant character of the massive 'bull quartz' outcrops so common farther south. Elsewhere the lode traverses rolling land carrying sparse digger pine, small oaks and some brush.

Angels Camp, elevation 1535 feet, has a rainfall varying from 20 to 54 inches annually, most of this falling as a rule between November first and May first. Orange trees have grown and borne fruit for many

years at Mokelumne Hill, 1550 feet elevation, where the mean minimum temperature over a period of 17 years never dropped below 36.8° F.

Water for mining has been supplied in the Angels Camp district by Utica Mining Company. The same company, and Pacific Gas and Electric Company, supply electric power to the mines, the latter company having a hydroelectric plant near the north county-line.

The lode is below the line where good timber grows, and nearby stands on the foothills have been cut; but there is plenty of good pine (largely yellow pine) in the higher hills within a short truck-haul to the east.

### Transportation.

Sierra Railway of California serves the Carson Hill and Angels Camp districts with a branch line from Tuolumne County. The northern end of the lode is served by a branch of the Southern Pacific Railroad to Valley Spring.

**Analysis of Gold Production, Calaveras County, 1914-1933, Inclusive**

| Year | County's total gold* | Mother Lode mines | | | |
|---|---|---|---|---|---|
| | | Tons ore | Average per ton | Gold per ton of concentrates | Mother Lode gold |
| 1914 | $1,336,875 | 358,436 | $2 22 | $23 99 | $797,267 |
| 1915 | 1,391,134 | 369,569 | 2 28 | 37 92 | 844,610 |
| 1916 | 1,356,120 | 402,278 | 2 13 | 36 10 | 857,583 |
| 1917 | 1,471,442 | 393,883 | 2 04 | 13 44 | 805,323 |
| 1918 | 871,263 | 306,510 | 2 08 | 20 20 | 638,626 |
| 1919 | 1,550,574 | 152,862 | 8 14 | 45 08 | 1,244,130 |
| 1920 | 1,439,745 | 126,800 | 9 13 | 57 51 | 1,157,983 |
| 1921 | 1,495,758 | 182,015 | 5 92 | 56 77 | 1,078,698 |
| 1922 | 1,413,465 | 183,733 | 5 76 | 54 91 | 1,058,920 |
| 1923 | 1,205,784 | 172,237 | 5 76 | 52 43 | 992,625 |
| 1924 | 853,961 | 142,078 | 5 08 | 68 22 | 722,847 |
| 1925 | 652,433 | 107,542 | 4 96 | 65 62 | 533,803 |
| 1926 | 576,889 | 92,798 | 5 07 | 77 45 | 470,844 |
| 1927 | 219,217 | 792 | 17 69 | 93 36 | 14,017 |
| 1928 | 162,372 | 1,516 | 9 87 | ---------- | 14,976 |
| 1929 | 103,843 | Pockets | ---------- | ---------- | 5,388 |
| 1930 | 112,913 | 576 | 6 63 | ---------- | 3,820 |
| 1931 | 152,771 | Pockets | ---------- | ---------- | 5,472 |
| 1932 | 186,378 | Pockets | ---------- | ---------- | ---------- |
| 1933 | 358,231 | [1]36,000 | [1]1 80 | ---------- | [1]65,000 |

* All gold values in this report are figured on a value of $20.67 a Troy ounce.
[1] Estimated, 1933.

*Angels Mine* at Angels Camp is an interesting example of a small Mother Lode mine which was operated at low cost on varying grades of ore over a lengthy period, because of careful management.

The claim from which the later consolidation took its name was first worked in the late 1850's and before 1870 had been worked to a depth of 186 feet and for a length of 350 ft. The ore in 1867 was said to yield only $8 a ton though assaying $15 to $20.

**Gold and Silver Production of Calaveras County, 1880–1933**

| Year | Gold, value | Silver, value | Year | Gold, value | Silver, value |
|---|---|---|---|---|---|
| 1880 | $320,865 | $643 | 1908 | $1,378,511 | $62,727 |
| 1881 | 800,000 | 1,200 | 1909 | 1,440,511 | 71,418 |
| 1882 | 670,000 | | 1910 | 1,147,705 | 82,866 |
| 1883 | 500,000 | | 1911 | 1,112,315 | 67,032 |
| 1884 | 485,000 | | 1912 | 962,145 | 70,748 |
| 1885 | 527,538 | 2,558 | 1913 | 1,175,208 | 61,076 |
| 1886 | 639,457 | 4,926 | 1914 | 1,336,875 | 60,442 |
| 1887 | 640,417 | 1,477 | 1915 | 1,391,134 | 53,298 |
| 1888 | 580,000 | 1,500 | 1916 | 1,356,120 | 83,643 |
| 1889 | 592,243 | 1,071 | 1917 | 1,471,442 | 87,984 |
| 1890 | 618,821 | 2,499 | 1918 | 871,263 | 84,150 |
| 1891 | 738,883 | 4,860 | 1919 | 1,550,574 | 35,876 |
| 1892 | 794,531 | 24,441 | 1920 | 1,439,745 | 16,701 |
| 1893 | 1,669,192 | 122 | 1921 | 1,495,758 | 10,232 |
| 1894 | 2,119,365 | 5,183 | 1922 | 1,413,465 | 11,648 |
| 1895 | 1,717,916 | 77 | 1923 | 1,205,784 | 7,316 |
| 1896 | 1,546,398 | 500 | 1924 | 853,961 | 7,463 |
| 1897 | 1,439,861 | 1,745 | 1925 | 652,433 | 8,324 |
| 1898 | 1,019,023 | 3,462 | 1926 | 576,889 | 6,229 |
| 1899 | 1,265,564 | 9,813 | 1927 | 219,217 | 3,982 |
| 1900 | 1,649,126 | 80,762 | 1928 | 162,372 | 1,469 |
| 1901 | 2,024,685 | 44,687 | 1929 | 103,843 | 3,444 |
| 1902 | 2,072,939 | 46,234 | 1930 | 112,913 | 1,555 |
| 1903 | 1,904,125 | 68,280 | 1931 | 152,771 | 989 |
| 1904 | 1,789,184 | 65,611 | 1932 | 186,378 | 763 |
| 1905 | 1,836,816 | 78,859 | 1933 | 442,980 | 1,937 |
| 1906 | 1,644,234 | 74,099 | | | |
| 1907 | 1,097,974 | 54,420 | Total values | $56,916,469 | $1,482,341 |

The Doctor Hill claim had also been worked seven years between 1857 and 1867. Although it was said it had yielded $250,000 this was less than had been spent on it. Both these mines were working a vein 15 ft. wide in the schist. By 1884 the Doctor Hill had been opened to a depth of 150 ft. where the vein was reported 13 ft. wide, of which 3 ft. was said to be very rich and the balance worth $10 to $12 a ton.

Billings, Crystal, Oneida, Doctor Hill, McCormick, Beda Blood, and Angels claims were grouped by Angels Quartz Mining Company in 1886 and this company operated continuously until March 1, 1918 since which date no work has been done. The total production of the property is not known. From 1900 to 1918 inclusive the output was about $2,000,000 from ore averaging from $2 to $10 a ton.

The later work was through the Angels shaft 850 ft. deep, from the lowest level of which a winze was sunk 200 ft. and the vein developed on the 1050-ft. level. The ore found on that level was considered to be too far from the shaft to be worked at a profit. A crosscut was run east 800 ft. from the 850-ft. level and a rich, narrow vein was mined for a length of 400 ft. It was followed both up and down until it pinched to a seam. Although the ore from this vein did much to 'sweeten' the mill-heads, the bulk of tonnage came from the stringer leads in the amphibolite schist. Two of these, called Mother Lode and East veins, were worked. The former was worked in places

20 ft. wide by shrinkage stoping. The footwall was hard diorite and hanging wall heavy, talcose schist. During the last operations ore was taken from the 200-, 400-, and 500-ft. levels. Stopes were from less than 100 to 200 ft. long. Crystal shaft, 600 ft. deep, on the west vein had been sunk 600 ft. but in the later years was used principally as a second entry.

The so-called talc or 'bull quartz' barren zone was cut in the Angels shaft at a depth of about 400 ft. It dipped east 45° and was cut again in the east crosscut on the 850-ft. level 400 ft. from the shaft.

The ore from this mine was crushed in a mill of forty 850-lb. stamps and Frue vanners were used for concentration. An extraction of 90 per cent was claimed. Concentrate formed 1½ to 2 per cent of ore and yielded $38 to $70 a ton. The mill handled about 200 tons a day.

This company claimed an operating cost of $2.25 a ton in 1913.

*Big Spring (Graham) Claim* covers 1200 ft. in length on the Bull Quartz vein 1¼ miles south of Angels Camp. This vein strikes about N. 20° W. and outcrops continuously throughout the length of the claim. The work has been superficial, in search of pockets, and the greatest depth reached was only 75 to 100 ft. in a shaft long since caved.

Demarest, McCauley, Pioneer, Martinusen, Johnson, Hale and Smyth claims, composing the old *Brown-Smyth-Ryland Consolidated* and adjacent ground, was last prospected in 1920–1921 by Angels Camp Deep Mining Company. The claims adjoin the Lindsay claim of Utica Mining Company on the east and northwest. The early-day production of these claims, from shallow workings, is unknown. From 1889 they made some small and irregular output. The Pioneer shaft was 187 ft. deep with 487 ft. of crosscuts and Smyth shaft was 140 ft. deep, with two levels and 692 ft. of crosscuts, before the last company started work. They deepened Pioneer shaft to 500 ft. on an angle of 83° with levels at 300, 400, and 500 ft.

The stringer lead formation was from 5 ft. to 32 ft. wide in different workings. About 1600 ft. of new drifts and crosscuts were run, but the small tonnages of material milled were not on the average of payable grade.

A 20-stamp mill which had been put on the claims in 1921 was sold in 1929 and removed to the Osborne property.

*Bruner, St. Lawrence* or *Bald Hill* Mine, two miles south of Angels Camp, comprises eight claims, Apex, Evening Star, De Wet, Spring Gulch, Cold Hill, Romaggi & Costa, Bald Hill and New Discovery. In 1897, the Bald Hill was worked in a small way by F. Bruner, who hauled ore to the Tulloch mill. Previously, this claim had been prospected to a depth of 300 ft. (incline) but there is no record of the results. In 1899, it was taken over by others and named the St. Lawrence. By 1900, the shaft had reached a depth of 400 ft. on an incline of 64° with levels at 100 ft. and 400 ft. in depth. There are no records of the results obtained. More work was done in 1913–1914 when mining equipment was installed but no ore was crushed.

The property was worked for placer and gold pockets in early days.

*Carson Hill Mines,* now being operated by Carson Hill Gold Mining Corporation, include Melones, Morgan and Calaveras mines all with separate former histories, extending from the Stanislaus River at Melones to the Bright Star claim of the Chaparral Hill group, including the Morgan, Union, Kentucky, Iron Rock, Relief, Reserve, Enterprise, Irvine, McMillan, Santa Cruz, Calaveras and other claims, covering about a mile and a half on the strike of the lode.

**History and Production.**

*Morgan Mine* was discovered in 1850 by Hance who took in six partners, one named Morgan. The claim lies on the northwest side of Carson Hill and was only 550 ft. long, but was so rich that it attracted thousands to the camp. The largest single piece of quartz gold (value $43,534)[1] ever reported is claimed to have come from this mine. It is said to have been about five inches in diameter and four to five feet long, and was part of a $300,000 pocket. The ore that was not rich enough to be worked in hand mortars was crushed in arrastres run by Mexicans, who were the only miners there who had had any previous experience in such work. In 1868[2] it was stated that the mine was locally credited with a known yield of $2,800,000 between February, 1850, and December, 1851, besides which large sums were supposed to have been stolen by Mexican 'high-graders.' In 1852 a band of several hundred outlaws seized the mine, drove off the owners, and worked it nine months until stopped by injunction. Thereafter, not much mining was done until 1867. This report stated the claim contained two veins which united 100 ft. below the surface. They were the stratified vein (ribbon rock) 6 ft. wide, and the boulder vein ('bull-quartz' vein) 40 ft. wide. The mine in 1867 had been opened only to a depth of 100 ft. where the ore-shoot was 200 ft. long. The boom had collapsed with the exhaustion of the specimen ore.

By 1898, a total depth of 500 ft. below the outcrop had been reached, with an adit and a winze sunk 200 ft. from its floor. The ore found in this work was reported worth only $3 to $5 a ton. Little more was heard of the mine until 1919, when Carson Hill Gold Mines, Inc., which had been working the adjoining Calaveras Mine, made a discovery in the Morgan. In crosscutting through the hanging wall of the 'bull quartz' vein they found a rich vein on the 300-ft. level. They began milling in 1919, stoping up to the 200-ft. level, and sinking. For 1919, the millheads were reported to have averaged $14.95 a ton for the first 60,000 tons crushed. Development was rapid. A new, large mill was built at Melones and after 1921 it handled from 9,000 to 15,000 tons of ore a month. Melones mine, which had been closed down by its former owners in 1918, was taken over, and its workings were utilized for handling the Morgan ore; and, as the Morgan ore-shoot passed into the Melones Mine because of its southerly pitch, the scene of operations moved into the latter mine below the 1450-ft. Morgan level. The former company had previously mined on the hanging-wall side of the 'bull-quartz' vein from their 1350-ft. to 3500-ft. levels. The later operations of Carson Hill Gold Mines, Inc., were on lower-grade ore than had been mined in the Morgan. 'Flat veins

[1] Hanks, H. G., Report of the State Mineralogist, Vol. II, p. 148, 1882.
[2] Browne, J. Ross. Mineral Res. of U. S., West of the Rocky Mountains.

which cut at a flatter angle across the hanging-wall vein and 'bull quartz' vein, furnished part of the tonnage in later work.

The production from the Morgan ore-shoot can not be exactly stated without examination of the company's detailed records, as part of the time ore was mined and milled from the Morgan and Melones

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Open cut or glory hole on Morgan claim of Carson Hill Co. Upper bench is site of old Fair shaft near which famous $300,000 pocket was taken out in November, 1854, including one mass weighing 2340 ounces Troy, valued at $43,534 (State Mineralogist's Report II, 1882). Note figure of man in lower center.

*Photo by Walter W. Bradley, May 24, 1934.*

mines simultaneously, including a good deal from the 'flat veins'; and the Calaveras mine produced small tonnages during several years up to 1925. From the beginning of 1919, when milling of the Morgan ore-shoot started, to the end of the company's operations in 1926, the production was as follows. Probably $4,500,000 or more of this was from the Morgan ore-shoot.

Work finally reached an inclined depth of 4550 ft. (see under Geology and Mine Workings) under Melones Mine. There is no record of any dividend having been paid and stockholders lost their equity when the bondholders ordered sale of the property, bonds amounting to $499,200. The combined properties were again formally placed on production September 4, 1933, by the present company. The first bullion was shipped in October. During October, 10,581 tons of ore was milled and was reported as yielding 870 fine ounces of gold. In November, 11,355 tons is said to have yielded 1026 fine ounces. During

Production of Carson Hill Gold Mines, Inc., 1919-1926

| *Year* | *Tons Ore* | *Gold* | *Silver* |
|---|---|---|---|
| 1919 | 77,871 | $1,024,616 | $6,525 |
| 1920 | 105,152 | 1,093,900 | 7,195 |
| 1921 | 175,755 | 1,059,989 | 7,257 |
| 1922 | 183,733 | 1,058,920 | 8,776 |
| 1923 | 172,066 | 990,716 | 5,371 |
| 1924 | 140,098 | 716,112 | 3,528 |
| 1925 | 107,440 | 531,699 | 2,898 |
| 1926 | 92,698 | 460,846 | 2,131 |
| | 1,054,813 | $6,936,798 | $43,681 |

eight months since reopening the production is reported to have been over $300,000. The ore being milled in September was reported as coming from four flat veins between the 875- and 1600-ft. levels in the Morgan and Melones mines; the 500-ft. level of the Calaveras mine and the Morgan glory hole. Later a gasoline shovel was placed on the Santa Cruz claim of the Calaveras Mine, and has been supplying a large part of tonnage milled. This ground had been extensively sampled by the former operators, before they discovered the rich Morgan ore-shoot. The old 1100-level Melones tunnel has been repaired and connected with the upper workings and electric haulage with a 5-ton locomotive has been installed in it, capable of handling a load of 100 tons. A total crew of about 160 men has been employed during the spring.

When the property was visited late in June, 1934, ore was coming from within the limits of the development work done by former operators.

On the Santa Cruz claim, a width of 20 to 40 ft. of schist was being mined by power shovel on the hanging wall side of the Calaveras vein. This was supplying from 150 to 200 tons in 8 hours which was hauled in trucks carrying 3½ tons about one mile to a loading chute. Thence it went by trolley locomotive to the mill in trains of 56 tons each.

The Morgan glory hole was reported to be supplying 300 tons a day to an ore-pass which dropped it to the 1100 level adit. From there it was being hauled by trolley locomotive a mile to the mill. Ore was also reported in the hanging wall vein on the 675-ft. level on the Morgan claim north of the old high-grade ore-shoot, and on the hanging wall of the 'bull quartz' vein from the 800- to 1600-ft. level.

The mill used by the last company has beeen rearranged in part and it was claimed it was handling ore at the rate of 20,000 tons a month in June, 1934. This mill retains the practice of coarse crushing with stamps followed by Hardinge mills, introduced by Loring. The approximate flow sheet is shown under Metallurgy, *post*.

**Geology and Mine Workings.**

Rich milling ore was found in the Morgan Mine in 1919 on the hanging-wall side of a 'bull quartz' vein on the 300-ft. level. The veins on the Morgan have been regarded as a branch of the Mother Lode, the main section passing through the Calaveras claims. This vein system, entering the Morgan from the Reserve claim of the Melones group, with a nearly westerly strike, curves and strikes nearly north on the Morgan and Union claims, dipping east 50° to 70°. The Morgan orebody occurred on the inside or trough of this curve. It had a southerly pitch which carried it over the south end-line of the Morgan into Melones ground about the 1450-ft. Morgan level. The section of this ore-shoot in Melones Mine had been previously worked between their 1600-ft. and 3000-ft. levels. It was pinched

Mill of Carson Hill Gold Mines, Inc., at Melones, Calaveras County. (Old Robinson's Ferry.)

*Photo by Walter W. Bradley.*

below 3000 ft. When opened later by Carson Hill Gold Mines, Inc., between 3000 and 4375 ft. inclined depth, it did not show either tonnage or gold content comparable to the upper section above the 1450-ft. level. Though locally termed an altered amphibolite schist, and so mapped by the U. S. Geological Survey, more detailed study has shown that on Carson Hill there are various gradations from pyroxene-rich rocks and others of basic igneous origin to amphibolite schist, chlorite schist and ankeritized sericite-schist. Knopf [1] states the Morgan ore-shoot "was not restricted to rock of any one type * * *. The ore consists of sericitic schist composed largely of ankerite with less pyrite,

[1] Knopf, Adolph. U. S. Geol. Survey P. P. 157, p. 176.

sericite, quartz and albite.'' Some galena, chalcopyrite, tetrahedrite, petzite and free gold occurred. Knopf also mentions molybdenite, and graphite was seen in places where the vein contained Calaveras schist or slate.

This ore-shoot had a length of from 140 to 200 ft. to the 425-ft. level; was 350 ft. long on the 550-ft. level, and below there to the 1450-ft. Morgan level had a stope length of from 140 ft. to 315 ft. It had a maximum thickness of 31 ft. on the 550-ft. level, and the better-grade ore was there 165 ft. in stope length; and on the 675-ft. level, the maximum thickness was 41 ft. This vein dipped on an average of about 70° to 1350 ft. inclined depth, where one of the 'flat veins' faulted the 'bull quartz' vein 210 ft. eastward. Below there, the 'bull quartz' and hanging-wall veins had a dip of 50°.

'Flat veins,' filling fault fissures dipping northeast at an average of about 30° were first struck at 985 and 1350 ft. inclined depth on the 'bull quartz' vein. They strike N. 70° W. Eventually five such 'flat veins' furnished ore. The one found at 1350 ft., the so-called 1100 'flat vein,' was the most important. The average stope length on it from 1100- to 1600-ft. level was 300 ft. or more and the average width stoped was 10 to 12 ft. This ore in 1924–1925 was yielding an average of $4.50 to $5 a ton and these veins were then furnishing about one-third of tonnage milled. This ore differed from that in the hanging-wall vein, carrying more quartz, but showing altered schist and coarse pyrite cubes in places.

Other workings on the Morgan mine included the footwall glory hole, 205 ft. long on the surface and extending to the 200-ft. level where it is 30 ft. long; and work on the footwall vein, on which a stope was opened 200 ft. long on the 550-ft. level. The Morgan levels were from 115 to 125 ft. apart, finally connected by the hanging-wall glory-hole, 1400 ft. deep. Many thousand feet of north drifts and crosscuts and raises were run. Below 1450 ft. the work, being in Melones ground, though now a part of the same property, is described thereunder.

*Melones Consolidated Mines* originally comprised 7 claims, named Stanislaus, Mineral Mountain, Reserve, Last Chance, Melones, Enterprise and Keystone. Most of these claims had earlier histories of operation before their consolidation about 1895. *Stanislaus Mine,* when worked in the 1860's, yielded rich ore carrying several tellurides, including *hessite, petzite, altaite, sylvanite* and *calaverite,* apparently in greater quantity than known elsewhere at the time. The vein, reported to have had a width of from 20 inches to 6 ft. on and near the surface, was worked through adits and shallow shafts to a depth of about 200 ft., where it was said to have broken into stringers.[1]

*Reserve Mine* was opened in 1860 and was reported to have produced $130,000 by 1868, from an adit and a shaft 135 ft. deep. Later an open cut was made to a depth of about 100 ft. Finally this claim became the site of the immense open cut through which Melones Mining Company drew so much low-grade ore, down to the 1100-ft. adit level. This was the farthest north of the claims of the latter company, being nearly a mile north of the river, near the top of Carson Hill. Here also, in early days, were found several of the tellurides mentioned,

[1] Fairbanks, H. W., R. X, State Mineralogist.

*ante. Melonite*, the telluride of nickel, $Ni_2 Te_3$ (with Co, Pb and Ag) was found only on this claim and was named for it. *Tetradymite*, telluride of bismuth, $Bi_2Te_3$ also was identified here and in the Morgan Mine.

*Melones Consolidated Mining Company* had, in 1898, a length of 5166 ft. on the Middle Vein and 1407 ft. on the East Vein. They had begun prospecting on the Stanislaus claim about 1895 through an adit. but in 1897 were evidently working principally on the Reserve. A shaft was sunk there on the East Vein, within 230 ft. of the Morgan line, to a depth of 200 ft. Drifts and crosscuts gave indications of a large orebody. The *South Carolina Mine*, adjoining Melones Consolidated on the south on the East Vein, was taken under option. A tunnel had previously been run 1080 ft. on the South Carolina. Melones Company continued this to a length of 3030 ft., reaching a point within 40 ft. of the Morgan line, and giving a depth 425 ft. below the 200-ft. level of Reserve shaft.

In 1899, a mill was started and in 1900 work was well advanced on the 1100-ft. level tunnel. In October, 1901, this tunnel was 4200 ft. long, having reached the vein 4000 ft. from the portal. A large project was also under way to supply water for power designed to operate under low head, with a flume $3\frac{3}{4}$ miles long having a capacity of 5000 miners inches. The first 60 stamps of the mill began crushing rock in 1902. The main adit (1100-ft. level) was eventually extended to 5000 ft. At the place where the adit crossed the vein, an internal shaft 5 ft. by 17 ft. in the clear was sunk in the footwall on an inclination of 70° to 1350-ft. level, at which depth one of the 'flat veins' faulted the main vein 210 ft. into the hanging wall, and the dip of the main vein system flattened to 50° E. From there to the bottom (3000 ft. under that company) the shaft was on 50° inclination.

Melones Mining Company operated the mine until 1918 and quit milling in February, 1919. The footwall vein (on footwall of bull quartz vein) was worked by caving from surface to 1100-ft. level, the glory hole having been open this entire depth. From 1350 ft. to 3000 ft. mining was done by shrinkage stoping and mostly on the hanging wall vein, with ore chutes 40 ft. apart. For some years it was the practice to take ore during the dry season from the glory hole, and in wet weather from the lower levels. Melones Company apparently never discovered the upper part of the hanging-wall orebody; when this fine shoot was discovered in the Morgan Mine in 1918-1919, it was separated from some of the Melones footwall workings by only the thickness of the 'bull quartz' vein, about 6 ft.

The footwall orebody worked by Melones Mining Company was stoped for the following lengths: From 200-ft. level, 480 ft. long to 865-ft. level, where stope was 660 ft. long. On 1100-ft. level, 380 ft. long and on 1350-ft. level, 290 ft. long. It shortened below there and gave out at 2170 ft., where there was a stope 80 ft. long. The maximum width of this vein was 65 ft. but the average stoped was 25 ft. to 30 ft. wide. This orebody was what is commonly called a stringer lead, composed of hydrothermally altered amphibolite schist, charged with pyrite and traversed by numerous quartz stringers.

The hanging-wall vein (previously described under Morgan Mine) was shorter in stope length and leaner in gold content after entering

Melones Mine and below the fault which threw the lower part of vein system eastward.

Carson Hill Gold Mines, Incorporated, took Melones property in 1920. They sank a new internal shaft from the 3000-ft. level, 225 ft. south of the bottom of Melones shaft, on a 57° incline to 4600 ft. (including 50-ft. sump). From this, levels were turned at 3275, 3375, 3500, 3620, 3750, 3875, 4000, 4125, 4250, 4375 and 4550 ft. For some distance below the 3000 ft. level the hanging-wall vein was pinched. From 3500 ft. downward it widened somewhat. On the 4125 ft. level, it was stoped 150 ft. long and 19 ft. thick; on the 4375-ft. level, the stope was 70 ft. long and 20 ft. wide in 1924. In that year, of a total of 140,098 tons milled, about two-thirds came from the Morgan Mine and one-third from Melones. Though the latter was somewhat higher grade than the ore from the Morgan, neither the tonnage available nor gold content were sufficient to encourage deeper work. Operation was continued on the three mines (Morgan, Melones and Calaveras) until December, 1926, the last named receiving most attention during the final year.

#### Production of Melones Mine.

Melones Mine was always known as a low-grade producer, and during the operations of Melones Mining Company was worked probably at lower per-ton cost than any other large lode mine in the State. So far as can be learned, the average recovery for an entire year only once exceeded $2.70 a ton; and during only a few years was it over $2 a ton. The total production was about $4,500,000 under Melones Mining Company. There is no public record of dividends.

The mill, originally of 60 stamps, but increased to 100 stamps by 1905 and 120 in 1914 reached a maximum output of over 245,000 tons in 1917. Stamps weighed 1050 lbs. each and dropped 7 inches 102 times a minute, crushing through 20-mesh screen, with outside amalgamation. For concentration, 20 Frue vanners and 27 Wilfley tables were used, with reclassification and reconcentration of middlings. Concentrate was cyanided in a 20-ton plant. Later, the sand was cyanided by percolation and slime was treated by counter-current decantation. The total average recovery was 83 per cent to 85 per cent, with 92 per cent saved from the concentrate. The concentrate yielded from $25 to $44 a ton in gold and silver (the latter being present in very small quantity) and formed from 2½ per cent to over 4 per cent of ore. The operating cost was reported to be $1.60 a ton in 1913, but increased during the war so that the company reported it was costing about $20 an ounce to produce gold.

*Calaveras Consolidated Mine* (Calaveras, Santa Cruz, Ivanhoe, Mexican, Extension, Relief, Stevens and Brown and other patented claims, 17 in all), also a part of the present Carson Hill holdings, had a separate history under previous owners. In the early 1890's, an adit 1400 ft. long had been run northward from a point 50 ft. above the river on the Calaveras claim. Later a shaft was sunk 600 ft. deep, north of this and ore was milled with 20 stamps, but work stopped about 1895. Nothing more was done until about 1913. In April, 1917, the Calaveras became a producer again under Carson Hill Gold Mining Company, but after the discovery of the Morgan ore-shoot, and because

of the lower grade of the Calaveras ore, attention was devoted principally to the Morgan shoot and little further production was made from the Calaveras until near the end of the operations. In 1926 a large part of the production came from this mine. (See *ante*). The production between 1917 and 1920 was 82,591 tons which averaged almost exactly $3 a ton yield.

The Calaveras vein, often regarded as the main strand of the Mother Lode, was developed in later years through an adit entering the hill near Melones and following the lode nearly north for 2050 ft. Ahead of this the vein outcrop was extensively prospected by trenching. This main adit was called 1000-ft. level, all levels on this and adjoining claims being referred to apex of the vein on the New Year claim on the summit of Carson Hill. Trenching at intervals of 15 to 40 ft. when in

Open cut on Santa Cruz Claim of Calaveras Group of Carson Hill Gold Mines, Inc., looking southerly.

*Photo by Walter W. Bradley, May 23, 1934.*

ore was done from coordinate 850 north to coordinate 2350 north. The trenching across the lode generally showed two strands but in places three of low-grade ore separated by rock too low in gold content to make ore. Over 1500 samples were taken from these trenches. The width of the different strands that gave assays high enough to be of interest varied from 6 to 20 ft.

From the 1000-ft. level the lode was extensively prospected by raises to the surface, crosscuts east and west, and a winze (at a point 950 ft. north of adit portal) from which levels were turned at 1123, 1250 and 1375 ft. in depth. The first two of these levels were each run about 500 ft. north on the lode, but only a short distance south. Stopes were worked above all of these levels, a length of 210 ft. on the 1250-ft.

level, 316 ft. on the 1123-ft. level and 370 ft. on the 1000-ft. level, having been prospected in this way to a height of 40 ft. above each level. A poor zone nearly 800 ft. long separated two ore shoots, each about 250 ft. long, on the 1000-ft. level. This work had been done before the discovery of the Morgan ore-shoot, and we have no record of the work done in 1926.

The vein averaged 15 ft. wide in parts of these workings but generally about 7 ft. in width was classed as ore. It was in lenses and stringers of quartz in the altered amphibolite schist. In the 1130 stope, about 4 ft. of a total of 15 ft. was of stringer leads in the schist on the hanging-wall side; the rest was quartz containing small lenses and irregular bunches of schist. The sugary, crushed quartz showing a thin casing of schist was the best part of vein; the hard, glassy quartz contained only 60 to 70 cents a ton in gold. The footwall was swelling and hanging wall heavy and the workings were hard to hold open long, even with heavy timbering.

The sulphide content of ore was 2 per cent and in 1918 it averaged $68 a ton in gold. Ore was handled in a mill containing twenty 1250-lb. stamps, 2 Hardinge mills, amalgamating plates and Deister concentrators.

*Chaparral Hill Group* includes seven patented claims and two mill-sites three miles south of Angels Camp, the Bright Star claim of this group joining the Relief claim of Carson Hill Mines on north.

There is one of the massive quartz outcrops forming the backbone of the hill, and having a thickness of over 100 ft. in places. A series of shallow shafts and several adits have been run on these claims. On the Vanderbilt claim an adit was run 500 ft., mostly on the vein, and on Chaparral Hill claim a crosscut diagonally across the formation was 464 ft. long, giving a depth of 300 ft. below the apex. About 1922, Chaparral Hill Operating Company, a subsidiary of Carson Hill Gold Mines, Incorporated, began work and did considerable prospecting on these claims through the nearby Hardy shaft. No important ore discoveries were reported as a result.

The vein prospected is one of the schist stringer leads on the hanging-wall side of the massive 'bull quartz' vein. It had an average width of 15 ft.

So far as known, no production has been made in late years from these claims.

*Columbia Mines Company* prospected the *Columbia* claim 2½ miles south of Angels Camp in 1914-1916. A 2-compartment shaft was sunk 250 ft. on 62° incline. Levels were turned at 100 and 200 ft. and short drifts were run. The above company installed a 5-stamp mill, compressor and a gasoline hoist. A few hundred tons of ore was milled in 1914, but there has been no recent activity.

*Commodore (Golden Gate) Mine* is a mile north of San Andreas. Under the latter name it was reported as being worked in 1870 through an adit 450 ft. long. Apparently little more work was done until 1899, when the shaft was sunk 300 ft., the first 80 ft. vertically and balance on incline of 75° in the footwall. Crosscuts were run east to prospect the 'Commodore vein,' and drifts were run several hundred feet north on this on both the 200- and 300-ft. levels.

The 'Commodore vein' is reported to be a mineralized quartz diorite intrusive, with a crushed zone about 4 ft. wide on its hanging wall side also carrying some gold. Both walls are serpentine.

In May, 1900, a mill-test of 200 tons from these workings was made, with the announcement that if this averaged $4 a ton a 60-stamp mill would be built. There has been no further record of activity until July, 1933, when the work of reopening was begun by Best & Belcher Mining Company. A fire interrupted work in October, but progress has been made since and early in 1934 the 200-ft. level was being prospected by a crosscut.

*Demarest Mine,* though somewhat west of the line of the Mother Lode if projected on a uniform strike north, may be considered here because of its geologic associations. It is on Cherokee Creek in Secs. 9, 10, 15 and 16, T. 3 N., R. 12 E., about six miles south of San Andreas, on an agricultural patent.

It was first worked in the 1850's. An elaborate scheme for treating the sulphide by steam was a failure and it was 1898 before the property became active again. The shaft was deepened from the 100-ft. level at an angle of 60° in the footwall slates to 690 ft. and levels were run at 100, 300, 400 and 600 ft. From 1898 to 1901, inclusive, ore was stoped from the 400-ft. level to within 80 ft. of the surface. The total production for these years is claimed to have been about $40,000 from ore that averaged slightly over $8 a ton.

After 1901, the Demarest lay idle until 1924, since which year it has been the subject of several promotions, including Bear Mountain Development Company, Cherokee Development Company, and finally, during 1934, Alaska B. C. Gold, Incorporated. The first two of these did some underground work and milled less than 1000 tons of ore which yielded about $9 a ton.

Three veins occur in a width of 350 ft. but all work has been on the middle vein which lies at the contact of a strip of Mariposa slate about 150 ft. wide on the west, and one of the Calaveras formation some 200 ft. wide on the east. The average width of middle vein on the 600-ft. level is said to be 6 to 10 ft., but this could not be verified as the lower part of mine was under water at time of visit. The last work done by Cherokee Development Company was the extension of the 100-ft. level southward along the vein under Cherokee Creek, to a total length of 325 ft. Here the vein is reported to have widened from a few inches to a good workable width in the last 25 ft., with encouraging assays. The 300-ft. level is 300 ft. long; 400-ft level 400 ft. long and 600-ft. level 420 ft. long, all drifts having been run southward.

There are 20 stamps of which 10 have been erected in a wooden building; rock breaker, electric motors, 3 Frue vanners, hoist, 10 by 12 in. air compressor and 6 by 8 in. triplex pump.

*Fellowcraft Mine,* one-fourth mile north of San Andreas in the Calaveras slate is one of the old prospects on which no work has been done in late years. It has a shaft reported to be 230 ft. deep on an incline of 54°, with three levels, the deepest at 200 ft., from which the first vein, reported to average 2 ft. wide, has been drifted 100 ft. each way, north and south. Crosscuts were run east from the 100-ft. and 200-ft. levels to a zone of amphibolite schist and quartz reported 4 to 8 ft. wide, the crosscut on 200-ft. level being 135 ft. long. Some stoping

was done above 100-ft. level. The last production, less than $1,000, was reported in 1907.

*Finnigan Mine* covers 2100 ft. on the Mother Lode on north side of Carson Hill, adjoining Reserve and Enterprise claims of the former Melones Mine.

The vein mined in the past is on the footwall of the 'bull quartz' vein, and is the same ore mined by Melones Mining Company in their glory hole adjoining the Finnigan. The orebody, consisting of a stringer lead and mineralized amphibolite schist, has a maximum width of 100 ft. in the glory hole. It has a hard greenstone footwall, and the massive 'bull quartz' vein for hanging wall.

This mine is said to have been worked since 1872, but no record of production previous to 1897 is at hand. Since that year, the total output reported has been over $120,000. This has been partly obtained from milling the low-grade ore, and partly from pockets. Milling ore yielded from about $2 to $4 a ton. Mining from an open cut and tunnels gave low operating cost, estimated to have been as little as 90 cents a ton before the war. The old open-cut workings were on an ore-shoot about 200 ft. long by 70 ft. wide. The Hawkins tunnel was at a depth of 465 ft. below the outcrop. The Talbot tunnel ran 400 ft. eastward from the glory hole. The open-cuts of this and Melones Mine finally formed one immense pit and a suit against the latter company for trespass resulted.

The 10-stamp mill used before 1913 was replaced in 1920 by Lewis, Gilman and Moore and a few thousand tons of ore was milled in 1921. This yielded about $3 a ton in gold, one-half of it in concentrate, which formed 3 per cent of ore. In June, 1923, the glory hole caved in and it was reported the cave had crushed the Finnigan workings. Since then the tonnage handled has been small but there has been some production every year to and including 1931.

*Ford Mine*, at San Andreas, is another of those which have been prospected quite extensively in recent years without fulfilling the hopes of its operators. Geologically, it is an extremely interesting claim and this is undoubtedly the reason it has received generous attention from previous writers. For the details of geology, the reader is referred to past reports of the State Mining Bureau, particularly Bulletin 18; and to Professional Paper 157 of the U. S. Geological Survey.

The Ford has an inclined shaft 750 ft. deep with levels at 100, 200, 300, 400 and 700 ft. During the past 10 years it has been in the hands of several companies and each has been active a short time. The production record is meager. In 1895 and 1896 a small yield was reported, and it was said at that time that in earlier years considerable gold had been sluiced from the surface. Again, in 1899, a little over $3,000 output was reported. In 1924 a few hundred tons of low-grade was milled, and all the gold saved was contained in the concentrate, which formed 3% of ore, and carried some copper and lead.

There are reported to be four veins on the property, but later work has been devoted to two—the east and west veins. The main vein, where the present shaft was sunk carries some telluride ore and rich specimens have been taken from it on the 100-ft. level, at times well sprinkled with free gold, but limited in quantity. This vein,

according to Knopf is wide on the 300-ft. level, divided into stringer leads of 30 and 25 ft. in width by 30 ft. of dolomitized amphibolite schist. The country rock is amphibolite schist containing some layers of black slate.

*Gold Cliff Mine* includes the Pilot Knob, Gold Cliff, Madison, Fairfax, Excelsior and Peachey No. 1 and No. 2 claims, the last two being placer claims. The group covers 5400 feet along the course of what has commonly been called the main Mother Lode, because of the occurrence of bold outcrops of quartz so commonly associated with the main lode elsewhere. The distinction loses its significance here because the best producers of the camp do not show these outcrops and lie east of the Gold Cliff, the two branches being 3000 feet apart on the surface but the veins meeting at a depth of 2700 feet.

The upper part of the Gold Cliff was worked by an open cut. In these workings the hanging wall dips east at a steep angle and generally shows the massive barren quartz vein, forming the immediate hanging wall of the ore. The ore zone was over 100 feet wide near the surface on the north end. The footwall converges toward the hanging wall going south and in depth. The ore in this trough-like body was crushed amphibolite schist, traversed by nearly flat seams of quartz which are from a few inches to three feet wide. The entire mass in this crushed zone is said to have averaged $2 to $2.50 a ton, and was cheaply mined and yielded a profit.

Later a shaft was sunk from the bottom of the open cut and the mine and mill were operated until April, 1920. The orebody developed and worked in these later operations is a thick chimney of solid white quartz and crushed mineralized wall-rock lying at the juncture of two veins. The footwall is amphibolite schist, broken, highly mineralized and not well defined. The hanging wall is smooth, hard amphibolite schist, deeply grooved by movement. This firm and nearly plane hanging wall was preserved in the deepest workings of the Gold Cliff, and was one of the principal factors which permitted cheap operation.

The ore-shoot varied in dip from 30° to 65°, averaging 45° N., to the 1600-ft. level. Between the 1600-ft. and 1700-ft. levels there was a nearly horizontal fault, throwing ore several hundred feet north. For 800 feet the vein is nearly flat. A drift was run north that distance from the bottom of the 1700-ft. shaft and a winze had been sunk from near the face to a depth of 270 feet late in 1919. The ore-shoot on the 1700-ft level was comparatively short but was 25 feet thick. The white sugary quartz was said to be of no value, usually, the gold being in the crushed schist, and 65 per cent of it in the fine sulphides which formed as high as 10 per cent of ore. Coarse cubes of pyrite, probably representing the primary pyrite of the original igneous rock from which the schist was derived, are said to carry only $5 a ton. The fine crystals of pyrite yielded a valuable product, as the concentrate was worth from $50 to $80 a ton. The 1900-ft. level was the lowest being stoped, but the Gold Cliff vein had previously been prospected from the Utica workings at a depth of about 2700 feet from the collar of Utica (Cross) shaft, at the place where it intersected the Utica vein. It had been hoped that ore would be found at this intersection but results of the work were disappointing.

The Utica Mining Company operated a 40-stamp mill with 16 Frue vanners, and crushed 225 tons a day up to April, 1920, when adverse economic conditions and falling off in working efficiency of miners are said to have hastened closing. The owners report that the total production was $2,834,000.

*Great Western claim* (not to be confused with others of same name on East Belt) is at Altaville and contains about four acres. In November, 1896, a test run yielded well in gold. The shaft was then 70 ft. deep and the fissure or vein reported 6 ft. wide. Work was resumed in April, 1897, and stopes were opened on the 50-ft. and 100-ft. levels. That year over $10,000 production was reported. The shaft finally reached a vertical depth of 220 ft. and the 200-ft. level was turned, all levels running south. No further output was recorded after 1897.

*Gwin Mine* was located in 1851, and an inclined shaft 200 feet deep was sunk soon after. Some rich ore was found near the surface, but most of the ore to a depth of 400 feet was reported low-grade. About 1867, the mine passed into the control of Senator Gwin and from then until the end of 1882 was worked as a family property with only scanty records kept, and few of those available. In 1871, the Alexander Mine on the north was purchased. The property covers a length of 4989 feet along the lode. From the 400-ft. level to 900-ft. level, the average of ore milled was better than above; but no details of this period of work are to be had. From 1867 to 1871, forty stamps were in nearly steady operation. From April 7, 1871, to August 4, 1882, the total bullion output (including only one lot of concentrate, $11,565) was $1,399,146, and a contemporary report[1] said the mine had produced over $2,000,000. In 1882, and for many years previous, two mills with a total of 60 stamps, were operated. The stamps weighed only 500 lb. each, dropped 75 times a minute and crushed an average total of only 120 tons of ore a day. The ore evidently ranged in average value from $3 to $7 a ton in free gold and the best of it appears to have come from depths of 1300 to 1400 feet, where the vein reached a thickness of 20 to 30 feet. The average yield in 1882 was reported at $6 a ton and cost of mining and milling $3 a ton. On the 1400-ft. level the ore was drifted on for 1040 feet, and the south shaft had reached a depth of 1530 feet, before the mine was closed in 1882. The shaft was crooked and the mill and other equipment worn out; money was needed and gold mining at the time was in a slump.

The mine lay idle until 1894, when reopening began under Gwin Mine Development Company. In two years the shaft was sunk 1000 feet. By January, 1897, work had reached a depth of 1400 feet and the new 40-stamp mill was started. The following is a partial record of the results of this period of operation: January, 1897, to April 1, 1900—171,748 tons yielded $702,003.81; April 1, 1900, to April 1, 1901—99,211 tons yielded $419,421.48; dividends 1897–November 30, 1901, $266,000.

Soon after, the mill was enlarged to 100 stamps with 24 Frue vanners. In the year ended March 31, 1903, when 138,383 tons of ore was milled, the cost per ton for mining and development was $1.9443; for milling and concentrating $0.306 and for hauling, freight

[1] Cal. State. Min. Bur. R. VI, pt. 2, pp. 30-34.

and smelting charges on sulphide concentrate $0.1588 per ton of ore, a total of $2.4091 a ton. Wages at the time averaged $2.50 an 8-hour shift. Among the conditions responsible for low costs were the size of vein and length of orebody, and the utilization of water twice for power. After using about 200 miner's inches daily, purchased at 15 cents an inch for 24 hours, for running the hoist and mill, it was dropped down the canyon a vertical distance of 380 feet and used to compress air.

The mine was finally worked to a depth of 2850 feet, the last shaft having been sunk 2400 feet vertically with a winze 450 feet deeper, which was sunk from the 2400-ft. level at a point 450 feet south of main shaft. This deepest work is said to have revealed ore-shoots of a combined length of 450 feet and "hundreds of feet" of lower grade. The main ore-shoot above this had been as much as 1400 feet long.

The property has been closed since 1908, and as no state reports were published on the Mother Lode mines from 1900 until 1914, the following notes are taken from Report XIII of the State Mineralogist, written in 1896 when the shaft had reached 1335 feet.

> "A vertical shaft was started in the hanging-wall slate 485 feet from the vein * * * on May 1, 1894. * * * The 8′ by 15′ shaft is 5′ by 12′ in the clear, divided into three compartments and timbered from top to bottom with 12″ by 12″ Oregon pine. * * * A station was cut at the 300′ level and a tank of 4000 gallons capacity constructed under the floor for the purpose of taking up surface drainage. At the 700′ level a station was cut and a reservoir of 12,000 gallons capacity constructed. * * * At the 1000′ level a crosscut was run 69′ west through the vein, 15′ 6″ wide horizontal measurement, the footwall being 58′ W. of the shaft. A drift was run 125′ on this level, the vein being found to be 15′ wide; the material is somewhat mixed, but containing some good ore. At 1195′ the shaft reached the hanging wall of the vein, which at that point has a gouge 1′ thick. At 1245′, the footwall, hard black slate, was cut. * * * The development of the mine shows the strike to be N. and S. and the dip 77° E., and that the vein conforms very nearly in both strike and dip with the enclosing black slates. A dike of igneous rock is occasionally found accompanying the vein. It is light gray, fine grained, and appears to be a type of diabase."

*Hardy Mine,* comprising the Hardy and McCreigh and Reed claims, 9.05 acres in all, belonging to Hayward and Hobart Estates et al; lies on the north slope of Chaparral Hill three miles south of Angels Camp. In years past it produced a number of pockets from a large white quartz vein. From 1914 when 59 tons was crushed, until 1922, there is no record of work. In 1922 and 1923 the claims were prospected by Chaparral Hill Operating Company, a subsidiary of Carson Hill Gold Mines, Incorporated. It had formerly been worked through an adit 360 ft. long and a winze giving a depth of 300 ft. on dip. The old shaft, 170 ft. deep, was used as an entry for the later work. A small production was reported in 1923, since when no further work has been done.

*Jolly Tar Mining Company* was a promotion based on a lease and option to purchase Jolly Tar Q. M., a patented claim one-half mile north of Altaville on the Esmeralda Road.

Between 1920 and 1924 an inclined shaft was sunk about 300 ft., with short levels at 150 and 280 ft. The country rock is blocky, amphibolite schist with meager seams of calcite and quartz. The dump indicates that all the work was done in rock of this kind. No ore was found. The last activity so far as known was in October, 1926.

*Kirby Development Corporation* owns the *Bachman Mine* and the *Wells* property and have an option to buy the *Thorpe Mine,* all near Fourth Crossing on the Mother Lode highway.

*Bachman Mine* was prospected under option by California Exploration Company for some time after 1894, but evidently without important results. Work was started again in 1921 when some 40 tons of ore was crushed and paid well. The present company took it about that time. A new shaft was started 65 ft. southeast of the old 70-ft. one and was sunk 305 ft. on an angle of 75° with levels at 110 and 285 ft. The work on the 110-ft. level consisted of drifting and crosscuts on a quartz vein between a greenstone footwall and hanging wall of interbedded slate and schist. The south drift was about 70 ft. long; on north some 300 ft. of work was done, exploring a length of 130 ft. on the strike and a width of 60 ft. Assays were generally low on this level. On 285-ft. level, a drift was run 160 ft. west and northwest largely in a fault, and about 135 ft. southeast. Good assays were reported near the face of southeast drift, and at shaft. About 20 ft. north of shaft, a fault striking west is reported to cross vein and throw it north and west; another segment of vein 45 ft. long was later found on north between this fault and a second minor one. The sections of vein sampled ranged from 1 ft. to 5½ ft. wide; several other veins run from the Thorpe into the Bachman.

*Thorpe Mine* was worked by Thorpe in a small way before 1894. It is located on several small veins, showing on the surface material which carried some gold for a width of 50 ft. of mixed amphibolite schist, quartz and slate. Thorpe Mining Company began work about 1894 and produced a few thousand dollars in 1895, sinking the shaft to 637 ft. on angle of 73°. California Exploration Company erected a 30-stamp mill in 1898 and enlarged part of the shaft. They quit soon after, with no record of production. Nothing more was done until 1927 when the present company cleared and repaired the shaft and spent considerable time and money in reopening and sampling the workings, and doing some new work.

According to Alfred G. Kirby, ore was found "mostly where the margins of the main fissures are cut by zones of oblique minor fissuring. Usually only marginal parts of main fissures are ore-bearing, the central parts being too low grade to mine unless a cross-fissure causes enrichment." The veins are mostly in schist, and strike N. 60° W., with a dip of 53° NE., flatter than the dip of the schistosity of the schist. According to an old map, stopes had been worked to a height of 70 ft. above the 300-ft. level and from 30 to 40 ft. above the 400- and 500-ft. levels before July, 1899. Though most assays on the 500- and 600-ft. levels are low, there are several short sections showing fair values, notably one behind the shaft on 600 north drift where the width sampled varied from 14 inches to 5½ ft., and one on the 600 south drift.

The equipment on the Thorpe includes thirty 1000-lb. stamps, 100-h.p. double drum hoist, capacity 2000 ft. deep, compressor, electric motors and pumps. No work has been done since 1930. There is another old shaft on the Thorpe about which information is lacking.

*Lightner Mine* at Angels Camp, between the Utica and Angels Mines covers only 420 ft. on the Mother Lode. It was first opened and

equipped with a 10-stamp mill about 1860, but the material milled from an open cut to a depth of 70 ft. did not repay the cost of operation. Production was resumed, at first from surface ore, in 1896. From then until 1910 it was in steady operation and a producer annually; and after an interruption in 1910 due to the caving of the old shaft, was productive until 1915, since which time there has been no underground work.

The Lightner produced between 1896 and 1915 over $2,500,000. Lightner Gold Mining Company was incorporated in 1896 with a capital of $125,000 in $1 shares, of which 62,287 shares were issued. Dividends amounting to $550,000 are reported, and when the property was closed the management claimed the mine still contained 200,000 tons of ore above the 300-ft. level.

Geologically, the deposit is the same as those in the Angels and Utica mines. The main vein was reported 120 ft. wide between the 4th and 6th levels but split into three strands on the 6th level, 100 ft. north of the shaft. The 'talc' or 'bull-quartz' vein cut across the main vein between the 500- and 600-ft. levels. The ore vein is claimed to have been picked up below the 'talc vein' in a crosscut run 150 ft. on the 900-ft. level, but its dip had steepened to 80° E. The walls of the vein are hard, but the country considerably broken by movements caused by the removal of large orebodies in this and the adjoining mines, so heavy square-set timbering had to be employed.

After the old shaft had caved in 1910 a new one was sunk 255 ft. from it and levels were turned at 100-ft. intervals to a depth of 600 ft. This shaft was finally sunk to 1050 ft.

The drainage problem would have to be considered carefully in connection with any plan to reopen and deepen this or Angels Mine, due to the great amount of ground opened in past years in the adjoining mines now standing idle.

*Madison Mine,* adjoining the Gold Cliff on the south and also belonging to Utica Mining Company, is similar geologically to the Gold Cliff. It was opened many years ago by an inclined shaft 1500 feet deep with levels 100 ft. apart, the longest connecting with the Gold Cliff. Other long drifts were run south. These drifts which were run for prospecting purposes with the intention of opening a large low-grade producer, were from 6 to 20 ft. wide and 10 to 20 ft. high and the rock from thousands of feet of such work is said to have paid when milled. The material was so low-grade, however, that it was decided that it would not pay for extensive stoping, considering the expense that would have been incurred for the heavy square-set timbering or filling that would have been needed to support large openings.

The auriferous rock was the chloritic amphibolite schist similar to that in the Gold Cliff, lying on the footwall side of a massive quartz vein from four to 60 feet thick, which was found to be low-grade in gold content everywhere in the mine. The auriferous schist was from five to 20 ft. wide with 4 per cent auriferous sulphides, and was in places in contact with the massive quartz vein, but elsewhere separated from it. The big quartz vein was crushed in places and carried a heavy gouge on its hanging wall.

A 40-stamp mill was operated at intervals on this mine, which has not been active since about 1888.

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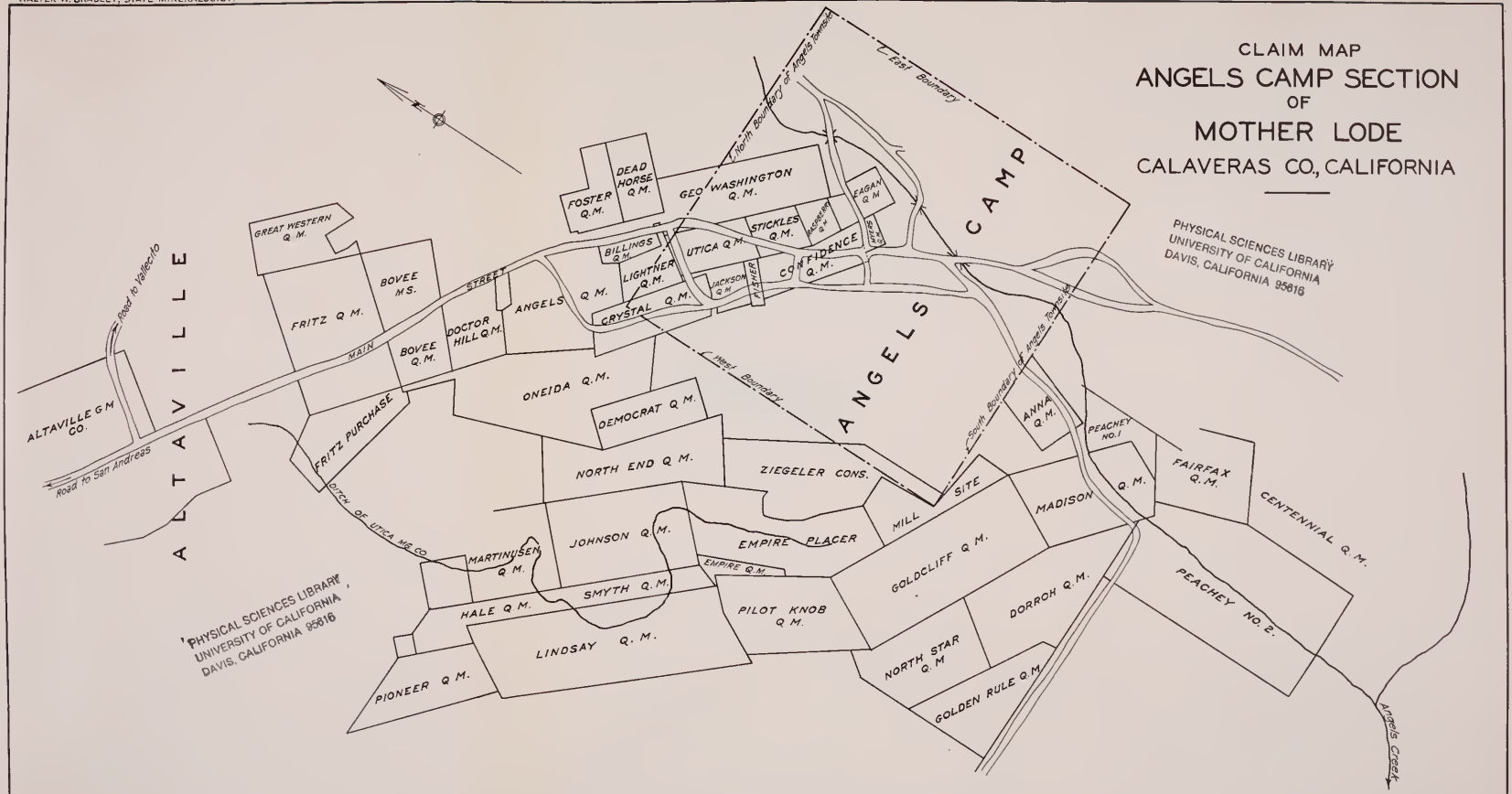


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*Maltman Mine* is another of the small ones between Angels Camp and Altaville, northeast of Angels Mine. It was worked to a depth of 75 ft. before 1900, and had a 4-stamp mill. By 1903, the shaft had been sunk to the 200-ft. level and in that year the last production of record was made, reported as averaging $5 a ton.

*Melones Mine* (See under Carson Hill Mine).

*Mohawk Mine* is two miles from Angels Camp on the Copperopolis road. It has a shaft 200 ft. deep, from which a crosscut 300 ft. northwestward on the 100-ft. level cut a black slate gouge with 3 ft. of broken quartz 50 ft. from the shaft; then 100 ft. of black slate or schist, followed by hard green schist. 'High grade' was found in small quantity 200 ft. from the shaft and 4 or 5 tons yielded $600. In all, the claim has produced about $8,000, mostly from shallow holes 20 to 50 ft. deep. There is a 2-stamp mill, small hoist and pump and electric power. Last work was done in 1924.

*Morgan Mine* (See under Carson Hill Mine).

*North Star Mine*, including North Star, Albany, New Discovery and other claims and mineral rights, is on a short westerly branch of the Mother Lode southeast of the Gold Cliff Mine. The deposit worked was in the characteristic altered and mineralized amphibolite schist of the district. The strike is nearly west and dip north. No record of the early history is available.

It was reopened about 1909 by Dolling Gold Mining Company who sank the shaft 480 ft. on 60° incline, opened levels 100 ft. apart and ran drifts reported to range from 60 ft. long on 400-ft. level to 300 ft. on 100-ft. level. A 40-stamp mill was erected and production was reported from 1911 to 1913 inclusive. The material milled was mostly low grade. An average width of 15 ft. was worked and ore was reported broken and scattered by faulting. The total production for the above period was less than $90,000. A large part of the gold was in the sulphide which formed 1½% to 2% of rock milled and assayed about $50 a ton.

*Oriole Mine* (also called *Harris* or *Big Bonanza*) a mile west of Angels Camp produced gold reported to have amounted to over $30,000 from pockets near the surface. In 1897, the Oriole Mining and Milling Company took out about $8,000 from a shallow shaft. A shaft in July, 1898, had reached a depth of 175 ft. In October, 1898, at a depth of 200 ft., the vein was reported 10 ft. wide. At 300 ft. depth, it was stated the vein was 50 ft. wide and on 400-ft. level was reported 30 ft. wide. The shaft finally reached a depth of 850 ft. while the Gould Mining Company was working there, with the first level reported at 130 ft. and others from 200 ft. down at 100-ft. intervals except at 700 ft.

This is another of the small mines of which we have only a fragmentary record. It made some production in 1903 under the latter company and this appears to be the last of record. The vein had been explored for 500 ft. south and 400 ft. north on the 500-ft. level, according to a statement published in 1903, but the State kept no records at the time and the full extent of work is unknown. A 10-stamp mill was

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operated that year and stoping is believed to have been done as deep as the 600-ft. level.

*Osborne Prospect* is 3½ miles west of Angels Camp in Sec. 30, T. 3 N., R. 13 E., on one of the mineralized zones characteristic of the amphibolite schist in that region. In early days this ground was worked superficially but no record remains of the output. The deepest old work was a shaft 101 ft. deep. In 1929 and 1930 Belmont Osborne Mining Company put down a new shaft which was 150 ft. deep when visited in January, 1930. The two shafts are 330 ft. apart and at that time a drift had been run 220 ft. southeast from the old toward the new shaft. This shows stringer lead material in sections from 9 to 15 ft. in length alternating with mineralized schist along the course of the drift. The face at the time revealed a width of 5 ft. in which there were two systems of quartz and calcite stringers—one system nearly parallel and the other about perpendicular to the strike of schistosity, which is a little nearer north than the course of drift.

A second-hand 20-stamp mill was erected and a small tonnage of rock was milled in 1930, since when there is no record of activity.

*Pioneer Chief Mine* is Lot 37 in Sec. 29, T. 4 N., R. 12 E., about two miles south of San Andreas. Other adjoining lands under agricultural patent belong to the same owners. No record remains of the early operation. Two shafts were sunk, one 125 ft. and the other 300 ft. and work had ceased by 1884. Fairbanks described it as "remarkable for having a gouge of forty feet on the hanging wall." He classified the footwall as a dike of chloritic felsite and the hanging wall as serpentine.

This claim has been unwatered and the workings have been extended laterally and in depth at least twice in recent years. The results of this work have been disappointing. Early in 1931, the deeper shaft (535 ft. long, or 415 ft. deep vertically) was unwatered. At that time, the 200-ft. level was 125 ft. long; 350-ft. level was 230 ft. long and 500-ft. level had been run 60 ft. Some further drifting was done on the 260-ft. level that year. The results of sampling did not substantiate claims made by the promoter and work stopped in a few months. The only record of production in late years was in 1928, when a small sum was realized from material yielding less than $2 a ton.

*Quaker City Mine,* Lot 44 in Sec. 26 T. 5 N., R. 11 E., four miles southwest of Mokelumne Hill is in the section where the Mother Lode fissuring re-enters the slate after having been in the greenstone for several miles. This claim was located about 1868 and opened in 1887 but was worked for only a short time.

The walls are black slate, but the slate on footwall side is said to be from only 6 inches to 5 ft. thick with a lens of greenstone next to it on that side. There is a heavy black slate gouge, said to be 30 ft. thick in the old workings, on the hanging wall of vein. The width of vein was said to vary from a few inches to 4 ft. and there is a gouge 4 to 12 inches thick on the footwall.

The claim was opened by a drain tunnel 640 ft. long connecting with a vertical shaft at a depth of 103 ft. The shaft was 108 ft. deep

in 1888, after which year no definite details are at hand. A Huntington mill was built, but there is no record of the production or gold content of ore.

*Rathgeb Mine* is three miles southeast of San Andreas, adjoining the Union Mine on the northeast. It had a 5-stamp mill in 1870, when the earliest production, amounting to $5,000, was recorded. By July 1, 1873, the shaft had reached a depth of 70 ft. and 150 ft. of drifting had been done, with 600 tons of ore on the dump which the owner reported was worth $7 a ton, containing 5% sulphides and coming from a vein averaging 4 ft. in thickness. During the next year 300 tons was crushed, probably of the above ore. The mill meanwhile was increased to 10 stamps. The shaft finally reached a depth of 220 feet, with short drifts on the 120-ft. and 200-ft. levels.

T. A. Rickard[1] has given an excellent account of the conditions under which a large pocket was taken from this mine in 1887 and excerpts are given.

> "These pockets appear to be confined to the zone between the surface and the water-level and to be dependent upon the results produced by the small cross-veins which encounter the main lodes. In 1887 I had the pleasure of extracting, in two hours, a little over 170 ounces of gold, worth about $3,000, from one of these pockets. It was at the Rathgeb Mine, near San Andreas in Calaveras County. The main lode consisted of 5 to 8 feet of massive "hungry-looking" quartz, the foot-wall of which was a beautiful augite-schist and the hanging-wall a hard diabase. The water-level was 160 feet below the surface. Down to this point, the country was oxidized, the hanging-wall exhibiting only slight alteration, while the schist of the foot-wall was softened and decomposed almost to a clay. This was traversed by numerous small veins, which appeared to act as "feeders," forming bunches of rich ore where they encountered the main lode. At the 120-foot level, south from the shaft, there were some old workings; and the examination of these led to the discovery of a small seam, about one-sixteenth of an inch thick, filled with red clay which carried a good deal of native gold. * * * It varied in thickness and occasionally opened out into small lenticular cavities, containing a clay in which the gold was distributed like the raisins in a pudding. Each of these "pockets" yielded several hundred dollars worth of gold. At length the streak widened to 6 or 8 inches of quartz, lined with clay. The amount of red clay commenced to increase; coarse gold became more frequent; and a big discovery was hourly expected. It was finally made. The vein suddenly became faulted, and at the place of faulting, there was a soft, spongy, wiry mass of gold and clay—more gold than clay * * * Within the next two hours this pocket gave us $3,000, and during the following week it yielded over $20,000, an amount which was obtained at a total cost of less than $200. * * * The vein, AC, had been faulted about its own width, namely, 10 inches, by a small cross-seam, DE, and at this intersection, B, the pocket lay. The gold was spongy and was intermixed with quartz. The clay which penetrated the whole mass was partly red and ocherous, and partly a gray gelatinous material. In the quartz, and associated with the gold, there were acicular black crystals of pitch-blende (uraninite) together with uranium ochre. This association of gold with uranium is uncommon."

Incidentally, it may be said that this appears to be the only reported occurrence of pitchblende in the State.

*Shotgun Mine* joins the Demarest holdings on the south. There are several shallow shafts, the deepest 125 ft. long, on the footwall vein, composed of quartz and slate ribbon rock and dike rock. This claim has produced some high grade ore, and a small crushing of low-grade ore was made in 1930.

In 1931 there was a hoist operated by a 12-h.p. gasoline engine, and a 10 by 12-in. compressor with a 4-cylinder gasoline engine housed in a corrugated iron building.

*Sultana* (first called the *Winters* or *Marshall* and later *Bovee Mine*) includes Bovee and Fritz claims, Bovee mill-site and Fritz Pur-

[1] The Formation of Bonanzas in Gold-Veins. Trans. A. I. M. E. 1901.

chase, lying on both sides of the main street adjoining Angels Mine on the north, at Altaville.

Winters Brothers found it in 1852 and worked by open cut, sorting the rock and crushing the best in an arrastre. They were locally reported as having obtained as high as $2,000 to $3,000 a ton, and were supposed to have produced about $200,000 before selling to Wm. Bovee. In the 1860's a 10-stamp mill and much other equipment was operated and the mine was opened to a depth of 300 ft. It was said the ore yielded from $6 to $26 a ton. The mill was burned down about 1870, but by 1884 a new one had been built and the property was being worked by Captain Cushing, "with fair results," but no details of this work are to be had. In 1899, Sultana Mining Company was formed and worked until 1905. They produced some ore that yielded over $6 a ton but most of the tonnage handled was low-grade. Their workings reached a depth of 700 ft. All ore from the 300-ft. level to surface has been stoped but it is said little was taken out below 300 ft. deep. The next and lowest level was at 700 ft. where the west vein was drifted 150 ft. and east vein 75 ft.

This property contains the Mother Lode veins. Near the surface four veins were mentioned as occurring in a width of 200 ft., with a 'main vein' of white, barren quartz. In the later workings only two, called East and West veins, were distinguished. They are separated by a layer of soft schist and lie between hard schist outer walls. They are essentially stringer leads, and are reported 5 ft. and 14 ft. in average width, respectively.

*Thorne (Illinois) Mine* is the next one north of the Demarest in the group lying on the west of the greenstone. It is the southermost of several claims, having a dike of serpentine on the hanging-wall side. It was worked principally during the period 1896-1900, when the State published only one short report on gold mines. A 5-stamp mill (later increased to 10 stamps) was put in operation in December, 1898, but nothing is known of the output. The footwall is slate and immediate hanging wall is schist. Two veins occur, one of 'ribbon rock' at the contact, and one of 'gray ore' in the schist. They converge going north.

The shaft was 200 ft. deep with two levels in 1900. There is no later record, but the shaft is said to have been sunk deeper.

*Tollgate Prospect* (Port Arthur, Marshall, Beaker and Prince agricultural patents), half a mile southwest of Altaville on the Copperopolis road, has an inclined shaft 150 ft. deep with levels at 100 and 150 ft. Less than 100 tons milled is reported to have assayed well and to have yielded about $4 a ton in free gold, with an unknown amount in the sulphides. This came from the 100-ft. level, but about 50 ft. of work on the 150-ft. level is said to have given assays too low to make ore. There is a 3-stamp mill, 1 vanner, small hoist and buildings on the property, which has not been worked for nearly 10 years.

*Triple Lode Mine (Blair Consolidated* and *El Dorado,* the latter a consolidation of El Dorado, Emeline and Jumper claims). It is 1½ miles southwest of Altaville and contains 53.6 acres, patented.

The Blair Consolidated made some production from ground sluicing in the 1880's. In 1893 a mill was operated and two small stopes about 20 ft. by 30 ft. were worked from the 150-ft. and 200-ft. levels

in the old shaft. The ore was low-grade. No further record of activity appears after 1898 until 1920 when Triple Lode Gold Mines, Incorporated, was formed.

The old shaft had been sunk 450 ft. with the above levels and one at 400 ft. This work was done on the west vein. A new shaft was sunk in the footwall about 700 ft. from the old one, to prospect other veins, and it finally reached a depth of 560 ft. Levels were turned at 150, 250 and 500 ft. and it is stated about 3000 ft. of drifts and crosscuts were run, of which 1500 ft. was on the 250-ft. level, where the middle vein is said to have been followed 200 ft. and the east vein is reported to have been crosscut about 200 ft. north of the shaft. On the 500-ft. level, all three veins are reported to have been cut. The hoist was not running when the writer visited the place and the workings could not be examined. The work was done in a northerly direction, away from the old shaft.

The company fell into financial difficulties in 1924 on account of labor liens, and a second-hand mill of 20 stamps which had been purchased was not erected. J. Gianera, 670 Greenwich Street, San Francisco, has numerous assays of samples from the later workings. The new shaft has a double-drum hoist, compressor, etc., but the old one is not equipped.

This is another of the group of claims in the amphibolite schist west of the main course of the Mother Lode.

*Tulloch Mine,* 2½ miles south of Angels Camp on an easterly branch of the Mother Lode, has been prospected at intervals over a long period. The production has come principally from small tonnages crushed at irregular intervals, and from pockets.

About 1917 the Lane interests deepened the shaft to 800 ft. and milled a small lot of ore. Again in 1921, W. A. Bisbee did some milling for the owners. In 1922, Chaparral Hill Operating Company unwatered the shaft for examination. The owners continued work on a small scale thereafter for several years. Since 1926 it has been in the hands of different promoters for short periods but they accomplished little new work. There was a little production in 1928 and 1929 from pockets.

*Utica Mine* comprises the Utica, Stickles, Raspberry, Brown, Washington, Dead Horse, Jackson, Confidence and Little Nugget, covering 6135 feet along the lode. The Utica, 300 feet wide and 634 feet long, and the Stickles, 300 feet by 600 feet, were worked before 1884 as separate mines. Their history had not been particularly interesting before that, and several failures had been made in attempting to work them, but they became part of the most important and most profitable group in the county and under the Utica Mining Company were operated until December 25, 1915, when the crew of 100 men then employed were paid off and the operations ceased. The fifteen years from 1890 to 1905 was the most important period in the company's history. As many as 500 men were employed at one time and the mines are said to have made a record in one month of $200,000 net production, exceeding the nearest competitor, Stratton's Independence, by $10,000. The gross output in the month of May, 1895, is reported to have greatly exceeded the previous record of $600,000 made by the Standard mine at Bodie in July, 1878. Many stories ascribe to these

mines a greater production than they actually made, as is usually the case where no figures are given out. However, during litigation Hayward, a one-third owner of the Utica, had to qualify as a bondsman and was required to show in court that he was worth $1,000,000. He produced a record of the operation of the Utica and Stickles properties from January, 1893, to September, 1895, showing that the gross production during that period, which included an idleness of two to three months, was $4,154,026.52. The expense was $1,683,414.24 and the net income was $2,470,612.28. The total production of the Utica and Stickles mines, according to figures furnished by the company, was $13,635,000. The net profit is hard to arrive at, because the three partners, Hayward, Hobart and Lane, spent very large sums in prospecting and developing mines throughout the length of the California gold belt and this money came in part from the profits of the mines at Angels Camp. They also spent a great deal on the development of the hydroelectric plant which still serves that region.

From a contemporary description of the ore occurrence by Lindgren, the following is quoted:

> "The ore body of the Utica mine is in the form of a stringer lead, consisting usually of numerous lenticular stringers lying nearly in the planes of schistosity of the amphibolite schist, and separated by various thickness of fissured and veined country rock. The stringers are largely quartz but carbonates are also abundant, especially in the smaller fissures. The wall rock near the stringers is impregnated with pyrite, but the gold is said to occur chiefly within the quartz of the veins. The stringers dip easterly, as a rule, but are nearly vertical. Some rich specimens were seen in which the gold was embedded in a gangue of calcite. Pyrite was the only sulphide noted in the ore. Unfortunately, the attitude of those having the mine in charge was such that no satisfactory scientific examination of it could be made in 1897.
>
> "The Stickles mine adjoins the Utica on the south and is under the same management. As in that mine, the country rock is amphibolite-schist, but it is in general more sheared and fissile than in the Utica. The ore body is a complex network of small stringers inclosing more or less impregnated country rock. True walls are lacking, and stringers occur in the country rock many feet away from the auriferous lead. The greater number of stringers follow approximately the planes of schistosity, but others traverse the schist in all directions. The ore body is separated into two longitudinal portions or leads, by a horse of barren schist (and stringers) 30 to 50 feet in width. The westerly lead is the more important, being from 60 to 90 feet wide, while the eastern lead is only 20 or 30 feet. The leads and the horse, however, are very irregular.
>
> "The filling of the fissures is sometimes quartz, sometimes carbonates, and sometimes a mixture of both. Pyrite and a little chalcopyrite were the only sulphides noted, the former being usually finely disseminated in small crystals through the vein material, and particularly through the impregnated schist between the stringers. The richest ore is said to be the so-called 'brown quartz' which is a fine granular aggregate of quartz, dolomite and sometimes albite, thickly speckled with small crystals of pyrite. This 'brown quartz' does not always form well-defined veins or stringers, but is very intimately associated with the country rock, and is in part an altered form of the latter. The other vein minerals are free gold, sericite and a little chalcopyrite. Gold is not visible in most of the ore, but occurs in considerable masses in certain rich streaks."

In Report XII of the State Mineralogist the method of operating underground and the character of orebodies being worked in 1893 at a depth of about 1000 ft. are described. Stopes then were from 10 ft. to over 100 ft. wide. The report states that

> "In these broad portions are found ribs or masses of rock containing little or no gold. The entire gold bearing zone, as it must be called in contradistinction to a simple vein, consists of a great mass of altered diabase, which by shearing and pressure has been rendered splintery or slaty and subsequently altered to chloritic and talcose schists, with the infiltration of much silica into the magnesian rocks and the replacement of large masses of crushed diabase by solid massive quartz. Both the quartz lenses, bunches, and veins and the magnesian schists, contain gold and auriferous pyrites."

Square sets of heavy round timber were used varying in diameter usually from 18 to 30 inches. Timbering then cost 30 cents a ton of

ore. Drifts and other workings were large and all waste rock was used in filling stopes. Later, when in lower-grade ore in the deeper workings, the pillar system was used to save timber. The Cross shaft finally reached a depth of 1470 feet. About 1100 feet north of it on the 1400-ft. level a winze was sunk 1650 feet, and from the 1500-ft. level of these workings a crosscut was run to the Gold Cliff. The Stickles shaft was 1000 feet deep, with a winze from the 1000-ft. level.

The grade of ore in the mine varied greatly and at times rich 'pockets' were encountered in the Utica as well as in the other mines of the district. Mill-head values were never revealed during the earlier operations but probably went as high as $15 a ton at times. There were 120 stamps with a capacity of four tons per stamp daily in commission in 1895 at the Utica and Stickles. The bulk of production came from above the 1300-ft. level. At about that depth in the Cross shaft, and at shallower depths to the north, a fault, filled by a talc zone 15 feet wide with a dip south and east, traversed the mines of the district and although confirmatory details are lacking it appears that this was the limit of the good ore. In the later operations the ore from the Utica averaged $3.60 or less per ton. The working cost in 1913 was $2.15 a ton. At that time 155 men were employed and most of them were paid $2.50 to $3 a shift. Timber cost $2.30 per stick, and lumber $18 a thousand feet. Sixty stamps were operated and gave a daily capacity of about 300 tons, indicating an output of nearly two tons per man daily. A big item in favor of the company was the fact that they owned their own supply of water and generated electricity from it for mine use. They figured this power cost $2 per horsepower per month, or less than one-half the rate then being charged by a public utility company near by.

*Waterman Prospect* comprises two claims, the Fairfax, 600 feet long, and Centennial, 1500 ft. long, and a millsite, all in Sec. 3, T. 2 N., R. 13 E., adjoining the Madison Mine on the south. The country rock is the amphibolite schist of the Angels Camp mines.

A shaft 225 ft. deep has been caved for years. The work of the Waterman Mining Company about 1914 was stopped after some diamond drilling had been done and a concrete foundation placed around the shaft collar.

A 'diorite dike' or rib of unaltered rock adjoins the vein on the hanging wall (east) side of vein and it is claimed the vein can be traced from the north end of the Gold Cliff through the Madison and Waterman claims. It is similar to the material mined in the former properties. The fissure narrows on the surface about 800 feet north of the south line of the Centennial. The owners report that several of the diamond drill holes indicated milling ore of good width. Assays on the surface indicated grades to be expected in the schist ores of the district with occasional much richer spots. Drill holes giving the reported good assays reached 300 feet in depth.

*Ziegler* and *North End claims* (later called *Etna King Mine*) are between the Gold Cliff and Utica Mines at Angels Camp. Early in 1897, an adit had been run along the vein for 180 ft., showing a body of ore which was believed to be from 25 ft. to 40 ft. wide. There is no record of production at that time, however.

Late in 1904, Etna King Mining Company put a plant, including 20 stamps, on the claims and worked for several years, making some production in 1904, 1908 and 1909. A vertical shaft was sunk 240 ft. and levels called 100-ft. and 200-ft. were run 200 and 300 ft. respectively on the vein. A small stope was worked above the 200-ft. level.

The property was closed, it is said, because of financial troubles. The vein is a westerly branch of the Mother Lode and is said to average 12 ft. wide, consisting of a stringer lead in amphibolite schist. The recorded amount of ore milled was less than 3000 tons.

In May, 1913 this company sued Utica Mining Company for trespass.

## TUOLUMNE COUNTY.

### Geology.

The Mother Lode traverses Tuolumne County for a length of nearly 15 miles, extending from Robinsons Ferry on the Stanislaus River, through Whiskey Hill, one mile west of Jamestown, through Quartz Mountain and Stent, thence southeast along the east side of Woods Creek and Tuolumne River.

The mines along this section of the lode have been found in the amphibolite schist or along the contact of that rock, or serpentine or other metamorphosed igneous intrusives, with the Calaveras (Carboniferous) rocks. The Mariposa slate lies west of the principal mines and although it extends the whole length of the county, not a single important mine has yet been found in it, though some are near its contact with the amphibolite schist. The region extending from a mile northeast of Chinese Camp to two miles northwest of Rawhide Mine, a length of 6½ miles and a width of two miles, is occupied by a large body of altered diorite, and another, on the east, of serpentine. The principal mines (except the Eagle Shawmut) follow closely the contact of this serpentine with the Calaveras rocks. We have here a condition similar to the case in central El Dorado County, where the lode has changed its course because of, or has been forced aside by, an immense body of intrusive rock. The displacement, if such it is, amounts to about a mile and a half to the east, going north on the lode. The difficulty in proving a fault here is twofold; the Mariposa slate maintains its normal course, and the canyon of Sullivan Creek is in the homogeneous amphibolite schist, where no contacts exist for markers.

Although the Mother Lode in this county is found in rocks of basic igneous nature its course is marked in many places by immense outcrops of white quartz and silica-bearing ankerite. Such 'bull-quartz' veins may be seen at Quartz Mountain, Whiskey Hill, Golden Rule Hill and Eagle Shawmut mine. These outcrops occur with broad zones of ankerite which are seamed with a network of quartz veinlets. The ankerite decomposes to a rusty mass with a skeleton of quartz and though it has often attracted the prospector, it has seldom been found of value for milling, except at the Rawhide Mine.

The problem of these prominent quartz veins and the immense quantities of ankerite so highly silicified, between walls of country rock so low in free-silica content is interesting but not necessarily difficult. One simple explanation for the presence of the silica would be that it was deposited following the intrusion of granodiorite and similar rocks, and had its origin in their magmas, representing deposition from cooling vapors and solutions escaping from the magma into the lode fissures and depositing silica when temperature and pressure dropped sufficiently to permit. Granodiorite and related rocks outcrop on both sides of the lode in this region, and these outcrops probably are linked to a buried batholith.

Ankerite is an iron-bearing dolomite containing more or less iron carbonate in solid solution, according to various authorities. Knopf distinguishes ankerite from the mixture of calcite, magnesite and ferrous carbonate by optical differences, and states that optical studies of some specimens from the Mother Lode indicate the rock there is true ankerite. Dolomite, however, according to F. W. Clarke,[1] is generally of marine origin, while magnesite most commonly is formed by the hydrothermal alteration of such easily decomposed rocks as peridotite and serpentine. The ankerite or mixed carbonate rock of this section of the Mother Lode is undoubtedly derived from serpentine or peridotite in most cases, though it may also come from the alteration of other basic igneous rocks or their derivatives. Whether the rock in question be a true ankerite or a mixture of carbonates, its manifest mode of occurrence in the widely separated sections of the California gold belt, nearly always in association with altered basic igneous rocks which yield serpentine, corresponds closely to the occurrence of magnesite. The network of opaline silica and quartz so characteristic of the weathered outcrops of ankerite is another criterion tending to prove this mode of origin. That the carbonate rock of this type is not uniform or homogeneous chemically over even a small area is well known to any field engineer who has made the simple test for solubility with cold, dilute hydrochloric acid. Ankerite, otherwise white or gray when fresh, is frequently colored green by the presence of mariposite, a mica containing chromic oxide derived from serpentine or its parent rock.

Another feature of the ores of the Mother Lode in Tuolumne County to be explained is the greater proportion of sulphides here. It is reasonable to refer this abundance of sulphides to the greater solubility of sulphides in femic magmas, whatever may have been the processes of alteration, solution and final deposition in the form of ore.

#### Ores.

The ores of the Mother Lode in Tuolumne County are not free milling in the same sense as are those of the mines in the Mariposa slate. A much greater proportion of the gold is associated with sulphides, principally pyrite, as depth increases. Some exceptions have occurred, as at the Jumper and Rawhide, but as a rule, the percentage of sulphide is two to three times as great as in Amador County quartz-slate ores, and the ores in depth are largely of medium or low grade. This has affected the methods of treatment used in later years.

There is no complex ore-treatment problem. Generally the concentrate is low grade and it would be an advantage if concentrate could be treated on the properties to save freight and treatment charges.

[1] Clarke, F. W. The Data of Geochemistry. Bull. U. S. Geol. Survey No. 770.

**Geography, Climate, Water, Timber.**

The Mother Lode courses along the western foothill section of the county, the elevation varying from 1000 feet in the southern part to 1700 feet at Quartz Mountain. In common with the rest of the lode, this section enjoys a mild, dry climate. Snow seldom falls and never lies on the ground more than a few days. Summer temperatures are often high, but the absence of humidity prevents discomfort, and heat prostrations are unknown. There is usually no rain from June until October. The annual average rainfall at Sonora, four miles east of the Mother Lode, is 35 inches. At Jamestown the average length of the growing season, over a period of 12 years, was 210 days.

**Gold and Silver Production of Tuolumne County, 1880–1933**

| Year | Gold, value | Silver, value | Year | Gold, value | Silver, value |
|---|---|---|---|---|---|
| 1880 | $461,861 | $1,071 | 1908 | $798,752 | $11,732 |
| 1881 | 500,000 | 1,000 | 1909 | 925,703 | 4,384 |
| 1882 | 400,000 | | 1910 | 615,626 | 5,754 |
| 1883 | 320,000 | | 1911 | 1,093,484 | 13,243 |
| 1884 | 310,000 | | 1912 | 1,113,291 | 25,146 |
| 1885 | 320,903 | 1,473 | 1913 | 974,409 | 24,381 |
| 1886 | 432,438 | 1,551 | 1914 | 940,793 | 12,017 |
| 1887 | 504,662 | 3,166 | 1915 | 1,058,103 | 13,480 |
| 1888 | 475,000 | 3,500 | 1916 | 868,237 | 17,039 |
| 1889 | 446,300 | 543 | 1917 | 321,085 | 7,808 |
| 1890 | 1,500,629 | 13,062 | 1918 | 274,328 | 21,425 |
| 1891 | 1,384,950 | 139 | 1919 | 471,021 | 11,076 |
| 1892 | 1,092,549 | 911 | 1920 | 254,569 | 6,007 |
| 1893 | 354,734 | 1,329 | 1921 | 96,026 | 2,505 |
| 1894 | 547,448 | 1,072 | 1922 | 222,366 | 2,976 |
| 1895 | 666,754 | 313 | 1923 | 261,936 | 2,801 |
| 1896 | 1,070,141 | 328 | 1924 | 253,994 | 1,106 |
| 1897 | 1,809,572 | 1,696 | 1925 | 155,592 | 614 |
| 1898 | 1,734,953 | 15,582 | 1926 | 119,873 | 1,119 |
| 1899 | 1,635,769 | 15,111 | 1927 | 40,209 | 302 |
| 1900 | 1,596,891 | 62,367 | 1928 | 36,807 | 185 |
| 1901 | 1,670,368 | 39,787 | 1929 | 70,957 | 2,735 |
| 1902 | 1,791,829 | 6,580 | 1930 | 67,691 | 300 |
| 1903 | 1,732,572 | 13,989 | 1931 | 77,902 | 180 |
| 1904 | 1,563,907 | 12,963 | 1932 | 93,939 | 214 |
| 1905 | 1,291,726 | 21,348 | 1933 | 107,736 | 280 |
| 1906 | 1,039,675 | 8,476 | | | |
| 1907 | 806,875 | 6,453 | Total values | $38,778,935 | $422,619 |

The Mother Lode is crossed at several places by the Sierra Railway of California, which connects with transcontinental lines at Oakdale, 30 miles west of Jamestown. The mines are all reached by good roads, branching from either the Yosemite highway, which enters from the west and runs near the lode from the vicinity of Jamestown southward to the county line, or from the Mother Lode highway, entering at the north.

Water and electric power along the lode are supplied mostly by a public utility. The three forks of Stanislaus River drain the northern part of the county and Tuolumne River the southern, but are not well situated for cheap utilization in mining.

Lumbering is the most important industry in the eastern part of the county, and large sawmills about 15 miles east of the lode can supply a variety of pine lumber. Logs for mine timbers are plentiful within 20 to 25 miles.

*Alabama Mine* adjoins the Crystalline on the north, covering 2600 ft. along the course of the Mother Lode. It was found in 1856 and up to 1890 was worked by an open cut 150 ft. long. It had a 40-stamp

mill which handled 60 tons a day, and the cost of mining and milling was low, probably about $1 a ton. Later an inclined shaft was sunk 300 ft. deep from the bottom of the cut (which was about 100 ft. deep). The estimated production was $150,000. The last reported production was in 1909, when 2302 tons yielded $3,765 gold and $52 silver.

The lode on the Alabama has a width of 60 ft. It is at the contact of serpentine and Calaveras rocks and shares the characteristics of the Crystalline.

The last work done on this property was in 1922 and 1923, when it was prospected by a drift which was run north from the 600-ft. level of the Crystalline to a point beneath the Alabama shaft, 820 ft. north of the south line. After passing out of the grey schist and 'bull quartz,' about 80 ft. north of the property line, this adit revealed slate and schist with several faults crossing the line of adit in a distance of 360 ft. It then encountered the 'bull-quartz' vein which was followed about 400 ft. A layer of brown schist two ft. wide lies between this and the hanging-wall slate.

So far as known, no crosscuts were run and the option was relinquished without any ore being crushed.

*Alameda Mine* is three miles northwest of Jamestown. It is just north of where the serpentine and Calaveras rocks turn west, and the lode courses northwest along a narrow dike (originally diabase but altered to amphibolite schist) which was intruded into the contact zone between the serpentine footwall and the Calaveras formation on the hanging wall. This dike is an outliner of the large area at Jackass Hill.

No definite details of early operations are to be had. The claim was worked superficially for a length of nearly 1000 feet. On the south end of claim the east vein was stoped to a depth of from 40 to 70 feet and a thickness of 18 inches to 2 ft. The south shaft was sunk 400 ft. deep to work this vein. Adits were also run to the vein from the east, the longest of them reported over 800 ft. long and 500 ft. deep, but apparently no ore was stoped from it.

Further north, the stringer lead or footwall vein widens to 160 ft. It is composed of stringers and small lenses of quartz in the typical ankeritic and talcose material of the region. The north shaft was sunk there to a depth of 920 ft. and six levels were run, with a total of about 3000 ft. of underground work. At the 600-ft. level, the vein was reported two to 12 ft. wide and on the 900-ft. level, 13 ft. wide. No information about assay values is to be had; the mine has been idle over 20 years. The east vein is reported to have milled $20 a ton.

There is no equipment on the property.

*App Mine* at Quartz Mountain was worked at intervals between 1856 and 1859, and thereafter steadily for many years on a small scale. The fragmentary records available are interesting. In 1873, the shaft had reached a depth of 800 ft. Ore that gave an average return of $15.52 a ton was found in the upper levels, where there were three oreshoots 75, 100 and 135 ft. long. These united at a depth of 180 ft. but gave out at 350 ft. deep and no more good ore was found until the 650-ft. level was run north in 1871–1872 and encountered an orebody 112 ft. long and 8½ ft. wide, assaying $14 a ton. During the late 1880's the product was small. The mine was evidently unproductive

from 1890 to 1897, when it became an important producer and continued to be one except for short shut-downs, until 1920.

During these years the App was part of three different consolidations. In 1893 in connection with the Heslep Mine, it formed part of the App & Heslep Mining Company. A new shaft was sunk and raised (using the old shaft as a working entry) on the footwall side of the ankerite and a new 20-stamp mill was erected. Thereafter the two mines were worked together until 1912 when a depth of 1340 ft. had been reached. In 1902 and later the operators of the App also worked the Rawhide Mine, and production figures were not always separated for the two. Again between 1915 and 1920, the Dutch, App, Heslep and adjoining claims were grouped and operated by Pacific Coast Gold Mines Corporation. That company did the last deep work on these claims. Because of these consolidations, it is impossible to allocate to each of the mines its exact production. For the App, a few production figures are informative.

From May 1, 1859, to September 1, 1866, a total of 8027 tons of ore yielded $124,575 or $15.52 a ton at an average mining and milling cost of $7.47 a ton. This was between the surface and 350 ft. deep.

In 1906, when the workings were 1300 ft. deep and a 60-stamp mill was in operation, 57,600 tons of ore yielded about $288,000 in gold and $3,300 silver including $77,000 gold and $1,200 silver from 1750 tons of concentrate. This indicates an average recovery of $5.06 in gold and silver, and concentrate of a value of nearly $45 a ton, forming a little more than 3% of the ore.

In 1909, the App Consolidated yielded 87,000 tons of ore which gave in round numbers $320.000 gold and $1,676 silver including $140,000 gold and $223 silver from 4000 tons of concentrate. From a total recorded production of $1,617,308 from 1888 to 1917 which can be credited to the App and Heslep with fair certainty, a weighted average recovery of $3.38 a ton is obtained for the period 1906 to 1912, inclusive, when 353,600 tons of ore was crushed. (See also Dutch Mine.)

*Geology.* The Mother Lode, as it passes through the several claims mentioned above, consists of a series of veins with a total width varying from 40 ft. on the north to 300 ft. at the south, forming at Quartz Mountain the central part of a hill 250 ft. high. The eminence is due to the hard quartz of the 'bull quartz' vein. The lode system is composed of quartz lenses and stringers, included fragments of wall-rock, serpentine, dikes, mariposite and ankerite. The weak zone at and near the contact of the Calaveras (Carboniferous) slaty schists and the hard amphibolite schist of the hanging wall has been a favorable place for movement, dike or sill intrusion and hydrothermal action. The veins in this zone are: West, App or Footwall, Middle, Heslep, Whitford (in Heslep claim), Bull Quartz, and Knox & Boyle. The various veins may pinch and form lenses or break into stringers and are not all continuous throughout the group of claims. The App (Footwall) vein was principally worked in that mine, the Heslep and Whitford in the Heslep, and the App, Middle and Heslep veins in the Dutch. The immediate footwall rocks are meta-andesite and serpentine, and amphibolite schist forms the hanging wall.

The Pacific Coast Gold Mines Corporation working through the Dutch shaft, explored the App and Heslep veins on the 1350-, 1500-,

1650-, 2050- and 2300-ft. levels, below depths reached in the old workings. Ore was mined and milled from the 1500-, 2050- and 2350-ft. levels.

The Footwall (App) vein averaging 10 ft. wide on the 1500-ft. level has the Bull Quartz vein for hanging wall; the Heslep vein, 15 to 20 ft. wide, is on the hanging wall side of the Bull Quartz. The Middle vein comes within 5 to 10 ft. of the Heslep vein above the 1500-ft. level and they were mined as a whole, 30 to 40 ft. wide. The veins strike N. 35° to 45° W. and dip about 65° NE. While the ore is sometimes solid quartz it is usually a stringer lead between a footwall of gray schist and a hanging wall of black schist, and may show the varying characteristics of 'schist ore' and ankerite. The percentage of sulphides appears to have been higher in the later work; the last company reported as much as 8% to 10% of sulphides, mostly pyrite. The apparent increase may have been due in part to release of more sulphide from the finer grinding for flotation.

At present there is no equipment on the claims.

*Atlas Mine,* a mile north of Tuttletown, is another of the Jackass Hill mines in amphibolite schist. The surface was worked for pockets in early days for a length of 1000 ft. Later a shaft was sunk 375 ft. and from 1913 to 1916 a few hundred tons of picked ore was produced, yielding from $13 to $55 a ton. The pay occurs in a stringer lead 10 to 30 ft. wide, and the percentage of sulphides is high, 6% to 10% of the ore, but the concentrate is low grade as is usual on Jackass Hill.

There is a 10-stamp mill with five concentrators, small electric hoist and air compressor, and tramway 600 ft. long from the mine to the mill.

From 1929 to 1931, F. H. Bernard worked the property and reported substantial production for 1931. There was also some activity in 1928 when Mark Twain Mining Company worked the Atlas and Chileno.

*Arbona Mine* adjoins Tuttletown, east of the main lode and south of the Patterson in the amphibolite-schist area containing the Jackass Hill mines. The vein, from 3 to 10 ft. wide, has been prospected by an inclined shaft 600 ft. deep with four levels at 100, 200, 350 and 500 ft. Two brief periods of activity are recorded—in 1900 and 1901 when about $6,000 was produced, and again in 1908–1909 when about 3000 tons crushed gave a return of $1.92 a ton. The concentrate during these two years averaged a little over $18 a ton. A few ounces of pocket gold was mined here in 1931.

*Bell Mine,* on the Mother Lode one mile west of Tuttletown, has been prospected by a shaft 630 ft. deep, sunk on the dip of the vein 70° to 74° E. Six levels were turned, the first at 40 ft. in depth and others about 100 ft. apart, but most of the work was done on Nos. 3, 4, and 5. The vein was explored for a maximum distance of 158 ft. north (on No. 5) and 180 ft. south (No. 4). Crosscuts are reported to have shown the following as an average cross-section, beginning at the Calaveras slate footwall: gouge, 5 ft.; ankerite, 6 ft.; 'grey banded schist,' 8 to 10 ft.; heavy quartz vein on hanging wall, which is amphibolite schist. The ore is reported to consist of quartz stringers and mineralized schist.

El Rico Mg. Co. did the last work on this claim in 1902–1904, and had a 10-stamp mill in which many mill tests were made; but the present owners claim to have no records of the results of these tests. There are two old buildings but no equipment on the claim.

*Bown Mine* is one-half mile south of Robinsons Ferry (Melones). In 1900, a shaft was sunk 700 ft. on this claim, at an angle of 64°, in the footwall and the vein was reached by crosscuts on the 200-, 300-, 400- and 600-ft. levels. According to Storms, the vein is 10 ft. wide between an ankerite hanging wall and schist and serpentine footwall. On the 400-ft. level, a crosscut was run 128 ft. into the hanging wall. A 20-stamp mill which was put on the property about 1900 was operated only a short time, when the mine was closed down and has been idle since, all equipment having been removed.

The only production of record was less than $500 in 1900, but tonnage milled is unknown.

*Chileno, Carrington, Rice, Santissima, Stocker, J. A. Gillis, Wilson & Means, Pine Tree, Last Chance* and other claims on Jackass Hill near Tuttletown are near the center of a mile-wide area of amphibolite schist. They lie about one-half mile east of the course of the main Mother Lode which passes along the west side of the schist.

The mines on Jackass Hill have been known principally as pocket mines, and are reputed to have produced about $500,000 from a great number of shallow holes.

In 1922, the claims named were taken under option by Nevada Wonder Mining Company. A shaft was sunk on the Chileno claim to a depth of about 500 ft. on an incline of 74° and levels were turned at 150 and 450 ft. On the 150-ft. level, encouraging assays were obtained at intervals over a length of 160 ft. On the 450-ft. level, over 1000 ft. of work was done, of which over 500 ft. was in crosscuts, but results on that level were disappointing and the option was abandoned after mill runs of 600 tons had yielded about $1.03 a ton.

The Chileno was then taken under lease and option by others and by them turned over to Mark Twain Mining Company, incorporated 1924 with $200,000 capital. Although the first few hundred tons of ore milled in 1925 assayed well, the average yield of about 3000 tons crushed was too low to pay expenses. To compensate in a measure, the operations, which had been expanded to take in the Atlas and other claims, in 1928 yielded nearly $10,000 in pocket gold. Since then the company has done little and have given up the claims, on some of which work was begun by others in 1933.

The ore occurs as a stringer lead of quartz and calcite in thoroughly altered amphibolite schist, with albite and sericite. In the mineralized zone which is from 4 to 9 ft. wide the schist is nearly white. Pyrite occurs, often in coarse crystals, and forms up to 15% of the ore. This pyrite carries most of the gold but assays only about $20 a ton.

*Clio Mine* is on Tuolumne River one-half mile south of Jacksonville. The original holdings included two patented and three unpatented claims. The group was enlarged by leases and options on adjoining land during the later operations, including the Imperial Gold Mines, Bell Boy and West Clio claims and E. R. Bolton land, making

a total of 637½ acres. Much of this land has since reverted to the previous owners and the Clio and other claims of the original group have been sold to the State for taxes.

This mine was first equipped with a 10-stamp mill in 1862 or 1863 and was worked five or six years, with recurring periods of short-lived activity up to 1926. The last company began work in November, 1919, and milled small tonnages of ore at intervals from April, 1920, until 1926. These later operations were unprofitable on the whole.

The northern part of the Clio claims is in the rocks of the amphibolite schist series. To the east, in the leased ground, and on the southern end of the claims, the workings entered some members of the Calaveras series, forming a narrow lens in the amphibolite schist. The footwall of the vein is serpentine, altered from peridotite. The hanging wall is one or another member of the schist series and in part the Calaveras rocks. The amphibolite schist, about a mile wide here, encloses the rocks named. To the west of it occurs altered diabase, then Mariposa slate. The mineralizing solutions found access at the Clio mine by invading the structurally weak contact zone between the serpentine on one side and schists or Calaveras formation on the other. The ore is altered amphibolite schist and as described by Knopf also included mineralized members of the Calaveras and chloritic schist. Some of the ore was in the form of quartz stringer leads, and dolomitic sulphide ore. Ore had a maximum width of 40 ft. but averaged 8 to 10 ft. The footwall serpentine was troublesome on account of swelling, and carried a heavy gouge. The ore was generally low grade, carrying $3.50 to $6 a ton in gold, mostly in the pyrite which formed 3% to 5% of the ore. Gold bullion was worth $12.68 an ounce.

The earlier work was through an adit called the 218-ft. level, and there was a total of 1100 ft. of drifts on this level. A 3-compartment shaft on an incline of 67° was later sunk to a depth of 930 ft. with levels at 306, 361, 473, 565, 700, 800 and 900 ft. The longest drift on these was 480 ft. on the 565-ft. level, and there was a crosscut 313 ft. east on the 900-ft. level.

The last reduction plant included 10 stamps, 3 Wilfley concentrators and a Vandercook mercuric cyanide outfit of 50 tons daily capacity. An extraction of 90% to 94% was reported.

Most of the material milled in the later operations was not ore under then existing costs, as it yielded only a little over $2 a ton on the average; although some small tonnages, less than 10% of that milled, paid from $5 up a ton. The deepest stoping was for a length of 160 ft. and width of 8 ft. on the 800-ft. level.

*Crystalline Mine* is north of the Harvard, a mile and a half west of Jamestown, on a contact between the Calaveras formation on the hanging wall and a large dike of serpentine on the footwall. There are two claims, Crystalline and Shore, parallel and each 1500 ft. long.

The early work was done in an open cut and ore was taken out through a tunnel and crushed in a 15-stamp mill during irregular periods of operation previous to 1890. Later a vertical shaft was sunk 625 ft., and an inclined shaft 300 ft. deep, and 750 ft. south of the first. From these, the vein was explored on the 300-ft. level from the south shaft to a distance 400 ft. north of the vertical shaft. On the 600-ft. level, the east and west veins were both prospected. The mine

has the three veins of the lode system, showing the usual local aspect of a central vein of 'bull quartz' with east and west stringer leads, or schist and sulphide ores.

In 1922 after the claims had been idle for years, the vertical shaft was unwatered to the 600-ft. level by Tonopah Mining Company and a drift was run along the vein system from the face of the old workings to the northerly property line and beyond, to a point under the Alabama shaft. The veins at this level pass on the dip eastward under the Shore claim. The formations traversed in this drift were the stringer lead of the 'bull quartz' vein, talc schist, talc mixed with quartz, and grey and black schist. The time agreed upon for prospecting work was not sufficient to permit of driving crosscuts; the drift followed quite closely the 'bull quartz' vein which is practically always low-grade and the two other veins were not explored to any extent, though it was found there is a mineralized zone about 150 ft. wide in the east vein section in the crosscut farthest south of the shaft. This was low grade along the above crosscut.

The workings at the time of the above work made about 10,000 gallons of water daily, most of which came from the 300-ft. level or above. It was handled by bailing.

*Dutch Mine,* at Quartz Mountain, was an early location but was worked in only a small way until 1891, when production exceeded $10,000 for the year. In 1892, there were four shafts on the claim, ranging in depth from 80 ft. to 210 ft. The production that year was $25,780 and ore was crushed in the App mill. The grade of this ore, which ranged in reported yield from $3 to $125 a ton, must have been high on the average, as the mill had only five stamps with an average capacity of only three-fourths ton per stamp-day. Late in 1896, one shaft was 430 ft. deep and 10 stamps were in operation on the mine. From then until 1906 the mine was in steady operation and produced, according to available figures, $780,662, the mill having been enlarged to 20 stamps in 1902. In 1906, the shaft had reached a depth of 1720 ft. and the ore decreased in grade. The mine was unproductive from then until 1910, when it was again put in operation after consolidation with the Sweeney claim on the north. From then to 1917, a 40-stamp mill was kept in fairly steady operation. A total length of 1800 ft. was explored along the strike, and 1867 ft. in depth on an incline of 65° was reached. An ore zone reported 1000 ft. long was stoped for an average width of 20 ft. Ore occurred in it in shoots running diagonally.

During this period the gross production was $1,126,689 and yield varied from $2.20 to $4.40 a ton. Concentrate varied in value from $35 to $42 a ton and formed from 3½% to 5% of ore. Operating cost early in 1914 was reported as $2.31 a ton.

In 1917, the Dutch, App, Sweeney, and Heslep were consolidated by Pacific Coast Gold Mines Company. The Dutch shaft was deepened to 2350 ft. inclined depth (2070 ft. vertical). About 17,000 ft. of new development and exploration work was done on the App and Heslep veins on the 1350-, 1500-, 1650-, 2050- and 2300-ft. levels. A large part of the work was done on the 1500-ft. level and ore from there and from the lowest two levels was milled. The App and Heslep claims

were prospected by some of these levels. The Heslep ore shoot was reported 400 ft. long on the 1500-ft. level, but at 2300 ft. had shortened to 40 ft. In the Dutch, ore shoots crossed the lode diagonally from footwall to hanging wall, and pitched north. The App, Middle and Heslep veins were worked there. The maximum width stoped in the Dutch (not by last operators) was 60 ft. between the 600- and 800-ft. levels. The grade of ore developed in the App and Middle veins by the last company did not permit working at a profit with their high costs during war time, and they closed the mines in 1920. During 1919 and 1920 they operated an expensive mill and flotation plant in which 54,433 tons of ore was treated. This yielded $175,447, of which $133,-516 came from 2616 tons of concentrate. The ore treatment is mentioned under Metallurgy.

*Eagle Shawmut Mine (Belmont-Shawmut)* has been described many times. The Eagle claim was worked at an early date, but no records of the results remain. The Eagle Shawmut Mining Company began work about 1895. The earlier operations had been through shafts sunk on the prominent outcrop. The company reopened the mine through adits driven from near Woods Creek, the main adit, 1100 ft. long, connecting with one shaft 450 ft. below the outcrop. The shaft was deepened to 2250 ft. and a winze in later years was sunk 900 ft. farther. In 1916, the mine passed under lease and option to a subsidiary of Tonopah Belmont Mining Company and for seven years was operated as the Belmont-Shawmut Mine. After being turned back to the owners in 1923 it was operated until early in 1926. Since then it has been idle; the mill was cleaned up in 1929 and most of the machinery has been sold.

The total production of the property from 1897 to 1926, inclusive, has been nearly $5,380,000. No record of tonnage of ore mined previous to 1902 is available. From 1902 to 1910 the weighted average recovered value of ore was $2.20 a ton. From 1911 to 1926, inclusive, the weighted average recovered value per ton was $3.90. Most of the gold and silver (the latter very subordinate in amount) was obtained in the sulphides. In 1906, when the ore returned only $1.84 a ton, the concentrate formed 3% of the ore, yielded over $41 a ton and contained 70% of all gold recovered. In 1915, when the ore was above the average, yielding over $5 a ton, 52,382 tons of ore yielded 5985 tons of concentrate of an average value of $39 a ton, containing 85% of all gold and silver recovered. This condition led Belmont-Shawmut Mining Company to radically change the method of ore treatment, doing away with amalgamation entirely, and depending first on flotation and finally on table concentration. (See Chapter on Metallurgy, where the flow sheet used is discussed.) In the last three full years operation concentrate averaged from 5% to 8% of the ore.

The ore occurs in a broad fracture zone, filled with quartz stringers and with much ankerite or dolomite, on the hanging wall of or within a basic dike, composed largely of basic feldspars. The 'bull quartz' outcrop is coextensive on the surface with the ore below. The footwall is a metamorphic complex of the Mariposa formation, largely schist, slate with narrow bands of sandstone, and limestone. The hanging wall is the Calaveras formation. Knopf has discussed the geology of the mine in detail and has summarized the sequence of events leading

to the formation of the ore, as follows: (1) "A basic plutonic rock (hornblendite, pyroxenite or peridotite) was intruded along a reverse fault fissure between the Calaveras and Mariposa formations. (2) Renewed movement on the fault highly sheared the peridotite and converted it into various chlorite schists, and at the same time auxiliary fractures were formed in the hanging wall rocks; (3) ascending mineralizing solutions altered the compact chlorite schist to bodies of sulphide ore and the other schist to quartz-ankerite rock, in which the quartz is locally so abundant as to form thick masses such as the Bull vein. Concomitant with this action the Shawmut vein was formed near or along the hanging wall of the sheared pyroxenite dike, and the subordinate or auxiliary fractures in the hanging-wall country rock also became filled with low-grade gold-bearing quartz."

Several varieties of ore have been worked. Siliceous ores occurred in stringers in the Calaveras rocks and where silicified masses of the wall-rock were caught up and held by the intrusive rock; also along or near the contact of intrusive and Calaveras rocks, where the Shawmut vein produced much of the low-grade ore mined in earlier operations. This strikes N. 32° W. and dips 70° E. On the footwall side between 1100 and 1400-ft. levels the ore and gouge were in contact and gouge swelled badly. Below 1400 ft. they were separated. On the 17th level the workings entered the dolomite or ankerite for the first time. In depth the dolomite-sulphide ore was principally mined. It occurred in well-defined overlapping lenses 8 ft. to 30 ft. wide. The ore was found on the crests of anticlines in the vein. Its sulphide content averaged as much as 8% of the ore (mostly pyrite) over a full year's operation, though locally higher.

The main shaft, long since caved above the adit level, has three compartments and is on the vein which has an average dip of 68° E., to between the 11th and 12th levels, then on an angle of 65°, being 80 ft. from the vein in the hanging wall at the 18th level. Its bottom is one-half way beween the 19th and 20th levels and is 2250 ft. vertically below No. 2 adit, which is 450 ft. vertically below the surface. The winze is sunk from the 19th level and the bottom of the 21st level is 3213 ft. on the slope below the surface.

Because of the heavy and caving nature of the vein, drifts were carried in the firm hanging wall and ore was developed by crosscuts. When the Tonopah Belmont Development Company took the property they excavated a large room on the adit level for a headframe and hoist, and installed pumps on the 16th and 18th levels. In 1918 they remodeled the mill (see under Metallurgy), retaining 70 stamps for crushing. For the last half of 1918, their experience gives a good idea of the reasons why so many low-grade mines closed during the war period. Wages for miners increased 26% and for millmen and mechanics 38% over those for 1917. Efficiency of labor at the same time decreased 65% of normal effort, and the labor turnover reached 280% in one month, although the company furnished very good board at reasonable cost, and working conditions were no worse than at other Mother Lode mines. The cost of mining supplies advanced 27.7%, the cost of water jumped from 12½¢ to 37½¢ per miner's inch daily, electric power cost increased 36% and freight rates and smelter charges were raised to such an extent that concentrate, which con-

tained most of the gold produced, could not be profitably shipped. In short, what had appeared to be an attractive opportunity had in a short time been transformed by outside and uncontrollable conditions into a strenuous struggle to make both ends meet.

*Gold Ridge Mines, Incorporated.* This is the last of several companies formed to work prospects on the Jones agricultural patent in Secs. 1 and 2, T. 1 S., R. 14 E., adjoining the Tarantula on the east, and containing 220 acres. In 1921, Tuolumne Giant Gold Mines Company had this land but did only a little work. The ground is on the east of the Mother Lode proper and covers a series of veins. On the east or hanging-wall side is the hanging-wall vein. The Jones vein, 800 ft. west of above, is a zone of quartz stringers 80 to 140 ft. wide in amphibolite schist. The Reitz vein, 600 ft. west of the Jones, is a solid quartz vein about 2½ ft. wide where seen. About 650 ft. further west is a stringer lead in black slate (in the hanging wall of the Tarantula vein), opened by the old Mexican Hill diggings some 800 ft. south of the line of the Tarantula adit if this were extended on its present course.

The last named company planned to prospect these veins by extending the Tarantula adit eastward, and this would give depths increasing from 400 ft. at the west property line. Nothing was ever accomplished in this connection. The only workings are shallow shafts, and numerous old open cuts and pits mostly dug many years ago by pocket-hunters. The deepest work is the Gage shaft sunk 110 ft. deep 400 ft. south of the north property line on the Jones vein, with about 100 ft. of drifting. The present company apparently bases its hopes on this stringer lode. Gold is said to occur where a series of flat quartz stringers intersect vertical quartz seams, but zones rich in $FeS_2$ in the schist may more probably be responsible.

Construction work on a new milling plant included the foundations and part of the building for a 300-ton ball mill. Other machinery planned but not installed at time of visit were crushers and concentrating tables. There is a good shop building housing a 60 h.p. motor, 420 cu. ft. compressor and drill sharpener.

*Harriman Mine* comprises three patented claims, named *M. B.*, *Sonora* and *Hayes* on the Mother Lode a mile and a half south of Jacksonville. The *Willieta* claim was also under option when the last work was done by Harriman Mining and Milling Company and with this the holdings covered nearly a mile in length. Oliver-Harriman Mining Company, Ltd., is the present corporation.

At this place the Mariposa slates are about 1500 ft. in width and are flanked on the east by serpentine and the Calaveras formation, with dikes of diabase. The principal workings are at the contact with serpentine on the footwall.

There are two shafts, both on the M. B. claim. No. 1 or north shaft is 500 ft. deep on 61° incline, with levels at 200, 350 and 500 ft. inclined depth. This shaft has two compartments to 350 ft. in depth and the balance has three compartments. Drifts have been run 280 ft. south and 150 ft. north on the 350-ft. level. The south drift is on the vein averaging probably 8 ft. wide, with one crosscut showing 35 ft. in width which is reported by the company to average $4 a ton. This ore-

shoot is believed to be 100 ft. long. It has a soft black serpentine footwall and a hard diabase hanging wall which has been crosscut for 70 ft.

The south drift on the 200-ft. level is 570 ft. long, connecting with No. 2 shaft. The 500-ft. level was under water at time of last visit in October, 1927.

The entire mineralized formation is 180 ft. wide, of which the portion next the serpentine is the footwall or 'bull-quartz' vein. In the south shaft workings at the 120-ft. level (probably inaccessible now) the diabase dike and later grey dikes run parallel. A zone of stringers in the diabase carried free gold where they ran to and were cut off by the grey dikes, forming small 'pockets' or concentrations of gold. The amount of such ore was small. A crosscut was run on that level 116 ft. east.

There is an electric hoist, air compressor of 340 cu. ft. capacity, 10-stamp Straub mill and one concentrator on the property.

*Harvard Mine* (*Whiskey Hill Mine*) is one mile southwest of Jamestown, covering the southeast slope of Whiskey Hill, which owes its prominence to one of the series of massive quartz and ankerite outcrops characteristic of the lode in this county. The group of claims covered nearly a mile along the strike during the period of operation, including the McCann, Mooney, Trio and Sobrante claims and Mooney mill-site.

It was discovered in 1850 and was worked at intervals until October, 1916, since when most of the surface plant has been removed. The Trio and Mooney claims, when worked in early days, produced ore containing about $4.75 a ton in gold and most of the ore has been medium- or low-grade, although one narrow vein at the serpentine contact in the south workings produced a small tonnage of very rich ore.

The claims lie at the contact of serpentine which forms the footwall, and amphibolite schist and Calaveras rocks on the hanging wall, there being a dike of altered andesite in the contact at this place. The croppings of the lode are 100 ft. wide near the highway and 300 ft. wide on the north end of Trio claim on Whiskey Hill. The central or boulder vein of 'bull quartz' is prominent, but as usual is for the most part very low in gold content. The ore occurred mostly in the stringer leads of the east and west veins and was partly black slaty material but largely the mineralized gray schist resulting from alteration and pyritization of amphibolite.

The principal period of activity began about 1900, the 60-stamp mill having been built that year. The mine was opened through two shafts, 1000 ft. apart. The north shaft, 700 ft. deep, was not used in later work. The south shaft was sunk vertically for 700 ft. Between there and the 800-ft. level the shaft entered a gouge 15 ft. wide, lying on the serpentine footwall, which was also so soft as to require special timbering. Double sets were used, to afford space for taking the swelling ground. To obviate expensive maintenance in such ground, the shaft was turned to an incline at 700 ft., following the vein on an angle of 58° and finally reaching a depth of 1850 ft. Levels were 150 ft. apart in the deeper section. Ore was mined by shrinkage with chutes 20 ft. apart. Seven orebodies averaging 200 ft. long and six ft. wide were worked. The veins were found to be faulted eight to 25 ft. by

a series of strike faults between the 1150-ft. and 1850-ft. levels. Faults struck N. 35° W. and dipped NE. 15°.

An operating cost of about $2 a ton was claimed in 1914 with 60 stamps crushing about 300 tons daily and with a total crew of 115 men. After the war started, costs rose and higher-grade ore was sought. In the last operations in 1917, an ore-shoot about 200 ft. long was found on the 1850-ft. level north of the shaft. The small rich shoot on the south, in contact with the serpentine, helped to 'sweeten' mill heads. Under the conditions existing during the war, the owners did not feel justified in sinking deeper, as would have been necessary to fully develop the new orebody.

Usual Mother Lode practice was followed in milling. The stamps weighed 1200 lb. each and 20-mesh and 40-mesh screens were used; added recovery with the latter did not appear to make up for reduced capacity. Concentrate was saved on Johnston vanners. It was nearly all pyrite, assaying $30 to $35 a ton in the last work. Total operating cost was about $3 a ton. Milling cost 30 cents a ton, which was very creditable compared with the cost at properties with similar ore, where more elaborate flow sheets were used. The recovery was 85% to 90% of mill-head assay value. The production of the Harvard from 1897 to 1916 was over $2,210,000. There is no record of the amount of production before 1897 although both the Mooney and Trio were equipped with stamp mills before 1867.

Very little work has been done on the *Pacific* and *Vulture* claims which adjoin the Harvard Group on the south. This work, in the form of surface cuts and a shaft 40 ft. deep, shows the characteristic veins of the lode running through the claims which cover 2700 ft. in length. The lode begins to narrow south of Whiskey Hill, and little work has been done for about one-half mile, until the Sweeney claim is reached.

*Heslep Mine* was located in the 1850's and by 1867 the surface had been mined at intervals for a length of 1200 ft., but nowhere over 90 ft. deep. The vein there was 8 to 20 ft. wide and recovery averaged $8 a ton. In 1873, at a depth of 270 ft., the ore-shoot in the Heslep vein was reported 10 ft. wide, 165 ft. long and milling value $9.75 a ton, including the concentrate which formed 2½% of the ore and assayed $40 a ton. By 1888, the Heslep shaft was 500 ft. deep and a 25-stamp mill was in operation. After the consolidation with the App in 1893, the two claims were worked together until 1912. In that year a cave-in occurred in the Heslep and 300 ft. on the north end was lost, to the 1000-ft. level.

In 1923, J. A. Keyes and associates obtained a lease on the part of the mine above the 300-ft. level. They installed 12 stamps, and for three years milled ore in small quantity. This came from the Whitford vein, between the Heslep and Bull Quartz veins. The ore-shoot was reported by Keyes to be 260 ft. long and to average 6 ft. wide. This had been stoped up to the 400-ft. level before the cave-in occurred. The remnant worked by Keyes yielded an average of over $7 a ton in gold and silver. The amount of silver in this ore was notably higher than in other veins of the district, at times exceeding in weight the gold content.

The last deep work in the Heslep and adjacent claims was done between 1915 and 1920 by Pacific Coast Gold Mines Corporation, which see.

~~Jackson Hill Mines~~ (See *Chileno et al.*)

*Jumper, Golden Rule* and *New Era Mines.* The geology of these mines, one-half mile south of Stent, is well shown in the accompanying sections.

*Golden Rule Mine* was operated in the 1860's and 1870's, and was said to have produced $48,500 in 1870 and 1871. At that time it was worked by means of open cuts and a shaft 200 ft. deep. About 1895 it was reopened and developed by a crosscut adit 528 ft. long from the footwall side, with drifts north and south for nearly 1000 ft. but at a depth of only 70 ft. This work was done on a zone of chlorite schist containing gold and auriferous sulphide; on the footwall side of this zone there were said to be narrow veins of quartz and calcite, rich in gold. A vertical depth of 530 ft. was finally reached in the shaft and a winze 800 ft. deep was sunk from the 493-ft. level. The mine produced about $90,000 from 1899 to 1902, but total output before transfer to the Jumper is unknown.

*New Era Mine* was also worked as a separate unit, through four shallow shafts, for some years prior to 1895. The greatest depth reached was only 100 ft. There is no separate record of production. Ore was crushed at the App. and it was said the ore-shoot was 750 ft. long. About 1895 this claim also became part of the Jumper, and as such was later developed to a depth of 1800 ft. through a shaft 1400 ft. deep and a winze sunk 400 ft. below the 1400-ft. level.

Although the Jumper and above claims were reputed to be particularly rich 'pocket' producers, this did not show in the average grades of ore milled. The principal operations extended from 1896 to 1914, when the mines were worked for company account by Jumper Californian Gold Mines Company. Thereafter, until 1919, the work was done by lessees. The period of heaviest production was from 1896 to 1904. For the years when tonnage figures are available, the average value recovered was $5.25 a ton. As shown on the sections, the mine was extensively stoped down to the 800-ft. level, but little below there. In July, 1899, when operations were in the zone from 300-ft. probably to 600-ft. level, the mill ran 23 days, and crushed 3500 tons of ore which yielded $27,500 or $7.85 a ton. During the same month, 810 tons from the Golden Rule east vein yielded $4,350 or $5.37 a ton, whereas 700 tons from the middle vein returned only $1,110 or $1.58 a ton. Average yield of course in such a case, while interesting and valuable to know, does not tell the whole story; because from time to time, as in April, 1895, rich strikes were made in the Jumper. At that time, one blast on No. 1 level knocked down $3,000 of 'high-grade' and for some days very rich ore was found; a quantity of it was said to be worth $10 a pound.

While large quartz masses with some gold and auriferous sulphide occur in the ankerite, the principal ore-bearing vein was in amphibolite schist on the east of the ankerite. Along the footwall of a silicified zone in this amphibolite schist, a narrow vein of quartz and calcite

occurred with a small gouge. This vein was frequently rich in free gold. A dike of diabase was intruded into this zone and was noticed to be larger on the Jumper than on the Golden Rule. The dike itself was often mineralized and filled with quartz and calcite stringers, forming ore. The superintendent, M. B. Kerr, believed the calcite stringers were responsible for the presence of coarse gold. This principal vein in the Jumper strikes N. 16° W., and dips 70° NE., and the calcite seams strike northwest across it, and generally dip north. The width of the principal pay zone is from 5 to 50 ft. Petzite occurs at times with the gold. The west vein contained low-grade material in large amounts.

The Jumper had a mill of twenty 1030-pound stamps in the 1890's and this was later increased to 40 stamps. Sulphides were apparently too low grade to save.

For several years after the company quit, lessees worked in the levels above 500 ft. Their total annual output varied from $8,000 to $85,000, and the value per ton was from $1 to $15, reflecting the uncertain occurrence of 'high-grade.' During the best year, only four sets of lessees out of seven made wages or better. Since 1919, the mill has not been operated and only a few thousand dollars production has been reported.

The incomplete records of output since 1896 indicate a gross of about $3,000,000.

*Mammoth* (Webster) *Mine* (later part of the Republican) is on the east side of Woods Creek, just north of where it enters Tuolumne River. The development of this claim was done principally by Sierra Buttes Mining Company in the middle 1890's. Four crosscut adits were run, the lowest and longest being 673 ft. long in 1896, and reported to give a depth of about 500 ft. below the outcrop on the dip. From near the face of this adit a winze was sunk 430 ft. in the gouge on the hanging wall of 'bull quartz' vein. The vein was prospected for a length of 500 ft. or more, but no exact record of the work remains. As much as 30 ft. in width carried some gold.

A 10-stamp mill was erected and a production of $40,000 was reported in 1896. The company gave up the property because of the low grade of vein, after several years' work.

*Mazeppa prospect*, adjoining the Jumper on the south has a shaft 800 ft. deep sunk on the vein, which is five to 20 ft. wide. The shaft was sunk in 1900 to over 500 ft. deep at an average cost of $19.65 a ft., and over 1100 ft. of drifts, crosscuts and raises were run at an average cost of $8.25 a foot. On the 400-ft. level a crosscut 202 ft. east is said to have shown two other veins. There is no record of value of ore. Since then an interesting surface prospect has been found, showing gold in decomposed ankerite.

*McAlpine Mine* is 17 miles from Chinese Camp and 4 miles from Coulterville. McAlpine Hill, one of the prominent quartz outcrops of the Mother Lode, is 2200 ft. high. It is stated that in early days this ground yielded $75,000 net to a depth of 150 ft. It is reported stoped out to the level of the adit which has its portal close to the shaft collar. In the McAlpine the lode is 100 ft. wide, containing large bunches of quartz; the best pay, however, is reported in the

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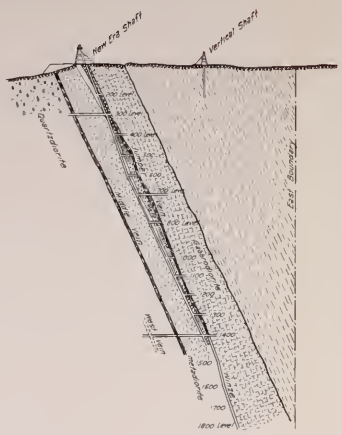


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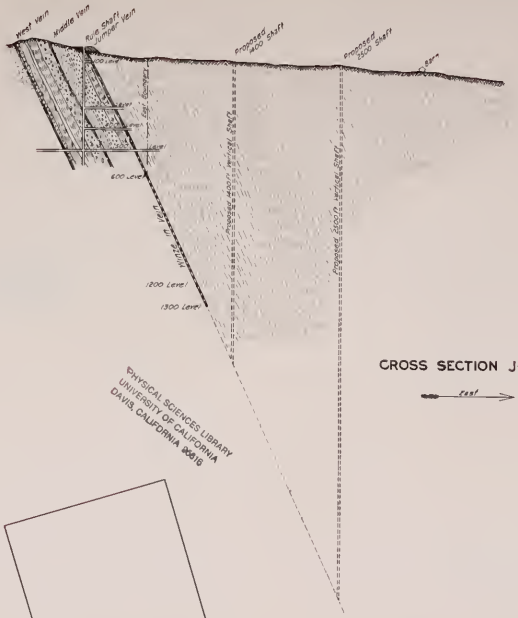
A – B

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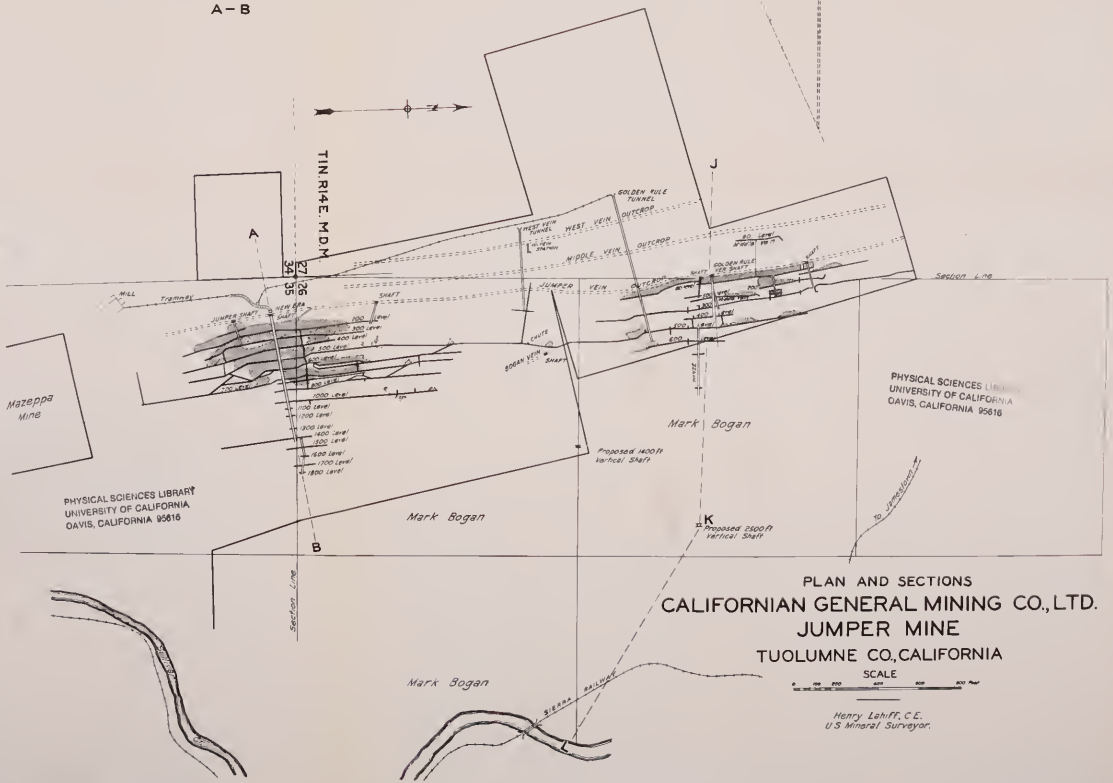


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PLAN AND SECTIONS

# CALIFORNIAN GENERAL MINING CO., LTD.

## JUMPER MINE

TUOLUMNE CO., CALIFORNIA

SCALE

Henry Lehiff, C.E.
U.S. Mineral Surveyor.

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McAlpine Mines Company was formed in 1914 and sank the shaft to a vertical depth of 670 ft., with five levels. Work continued intermittently until 1923 but nothing is known to have been done since. The company is no longer listed as active. The property has several buildings, an electric power line, and an old double compressor and single-drum hoist, each with a 75-h.p. electric motor.

*Norwegian Mine,* on the north slope of Jackass Hill east of the Mother Lode, has been worked in a small way ever since 1851. M. Lawson, the original owner and family were said to have produced over $80,000 prior to 1897, when it passed to new owners. For six years thereafter, it was a producer annually, the output in 1897 having been over $51,000. In 1898, the shaft was 355 ft. deep; in the 30 years thereafter it was sunk only about 200 ft. deeper. Since 1911, however, it has been a small producer nearly every year, with generally one or two men working under lease.

This mine is at the north end of the Jackass Hill amphibolite schist area, close to the contact of the Calaveras slate. The Norwegian vein was first worked to a depth of 190 ft. where a 'horse' was encountered. At 275 ft. in depth, this vein was reported 12 to 18 inches wide; at 350 ft. deep a body of rich ore 20 ft. long and six inches wide was found. In 1898 it was confidently believed it would develop into a producer of sufficient tonnage to justify 20 stamps, but this hope has not been realized. The largest tonnage mined in a single year was 398 tons, with a resultant low value of only about $10 a ton. The ore is almost entirely 'high grade,' characterized by the presence of petzite and other tellurides, and the sulphides of iron, copper and lead. The vein worked in later years is the footwall vein, 12 ft. west of the Norwegian vein and four to six inches wide. The ore zone containing these veins is an intensely altered band of amphibolite schist about 50 ft. wide. At places the veins have cut bands of slate and the operators have found these slate intersections favorable for pockets. The schist is impregnated with pyrite and carbonates, as is common on this hill, the pyrite content going as high as 10% or more.

*Nyman Consolidated* (*Santa Ysabel Group*) contains five patented quartz claims, two mill sites and mineral rights on 44 acres of other land, adjoining the App Mine on the south. It is a consolidation of the *Nyman, Knox & Boyle* and *Miller & Holmes* mines, which were grouped as the Santa Ysabel about 1896. Previous to that time, the Knox & Boyle had an inclined shaft sunk 600 ft. from a station cut in an adit level run from the south. The Miller & Holmes shaft was 360 ft. deep, and No. 1 (most southerly) shaft was 250 ft. deep at the same time, in addition to the older work. The Knox & Boyle ore was crushed in a 10-stamp mill. This mine had been the principal producer of the group but there are no definite details of tonnage or value of output available, either for it or for the other units. From 1897 to 1900, inclusive, the Santa Ysabel produced a total of about $115,000. Intermittent small-scale operations were carried on from 1908 to 1922 and the grade of ore varied considerably from year to

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year, but the bulk of it is reported to have yielded $4 to $6 a ton. Part of the time the work was done by lessees.

The claims are on Quartz Mountain, one of the large prominences on the Mother Lode caused by a wide outcrop of quartz and ankerite. The Knox & Boyle is on the east side of the 'mountain,' where a 'feeder' vein enters the lode from the northeast. The 'bull quartz' vein is as much as 150 ft. wide on these claims, and there is an abundant development of mariposite. Ore may be found in the East and West veins (so called because of their positions relative to the 'bull quartz' vein) and in the 'feeder' vein mentioned which is called the Knox & Boyle. The country rocks are amphibolite schist to the east and Calaveras slates on the west. The hanging wall of the East vein is reported to be an altered diorite dike, and the footwall mixed slate and schist but the mine has been closed every time a field trip has been made to the district, and no inspection could be made underground.

The ore-shoot opened by the Knox & Boyle 800-ft. inclined shaft is reported to have been continuous from the surface to the bottom of the shaft. It is said to have been about 100 ft. long by two or three ft. thick. It was worked down to the 800-ft. level. The Mascot or Central orebody was found about 200 ft. north of the No. one 850-ft. vertical shaft (on Miller & Holmes Mine) and mined from the 400-ft. level nearly to the surface. This also is reported to have been about 100 ft. long and 4 to 9 ft. thick, but was evidently lower grade than the first named.

Another shaft, on an incline of 60° and with three compartments was later sunk to a depth of 800 ft. at a point about 200 ft. north of No. 1 shaft. All or nearly all of a working capital of $150,000 was spent in sinking this shaft and running the drifts and crosscuts on the 400- and 600-ft. levels, with only a little production.

Nyman Consolidated Mines Company was incorporated in 1916 with a capital of $200,000 of which 161,586 shares of $1 par value were issued. They worked the property until 1918. Some good ore was stoped on the Knox & Boyle vein, but the average yield, over $6 a ton, was reported to have been a little less than operating cost. The last work was done in 1925 and 1926. This was reported unimportant by the company. Since then all equipment has been removed.

*Patterson Mine,* in the Tuttletown area of amphibolite schist east of the main Mother Lode, has been worked at intervals since 1858. In 1868 it was reported that the pay had been "good for 75 ft. from the surface but not so good below the water level." Like all the mines of Jackass Hill and the Tuttletown area, it is characterized by mineralized amphibolite schist containing a high percentage of pyrite, some of it in coarse cubes. Gold occurs at times within these cubes or as a thin film on their surfaces. The workings appear to have reached only shallow depth until later years, in spite of the fact that the property had several stamp mills. Previous to 1908, available ore had been stoped for a length of 500 ft. and an inclined depth of 450 ft., although the shaft was 800 ft. deep on 65° incline. There is no authentic record of the production during that period.

In 1920 the mine was reopened and equipped with a good plant, including good air compressors at north and south shafts, a mill of twenty 1200-lb. stamps, electric power and hoist. Work was done upon

both the Patterson and Lennon veins which are parallel. Such pay as was found occurred in stringer leads intersecting the Patterson fissure, which varied from 1 ft. to 12 ft. wide, strikes N. 65° W. and dips 65° NE. The Patterson vein was prospected over a total length (not continuously) of 2200 ft. The 160-ft., 260-ft., 400-ft. and 600-ft. levels were opened on this vein. On the 400-ft. level, about 1000 ft. was opened in length, including 485 ft. of new north drift from the north shaft. The Lennon vein was reached from the Patterson 200-ft. level by a crosscut of 145 ft. A depth of 385 ft. on the dip was reached on this vein, with a short drift on the 400-ft. level. From the 6th level crosscuts were run from the south drift and connection made with the south shaft.

Although the operators claimed some ore had been found, they suspended work early in 1922 after crushing a small tonnage of $3 rock. This carried a little less than 2% sulphide containing $23 a ton. Only a little dump material and picked ore has since been milled by lessees.

*Rappahannock* claim adjoins the Rawhide Mine on the north. The prospecting of this claim was stimulated by the successful operation of the Rawhide. An inclined shaft was sunk 1150 ft. in the serpentine of the footwall, and crosscuts were run to the vein on the 100-, 350-, 600-, and 1100-ft. levels. Drifts varying in total length from 250 ft. to 700 ft. were run on these levels, on a fissure said to have an average width of 10 ft. No ore-shoots were developed, although some prospects were reported and a heavy gouge was encountered. Some old buildings and a steam hoist remain.

*Rawhide Mine*, two miles northwest of Jamestown, is one of the important Mother Lode producers for which the owners state no detailed record is available and, due to the secretive policy of the operators during the principal period of production, the contemporary reports lack all the most interesting and valuable details of operation and results.

In 1867, this mine had a shaft 280 ft. deep, and a drift 80 ft. long had been run, showing a reported width of 12 ft. of ore ranging in value from $7 to $44 a ton. Malachite and 'argentiferous gray copper' were mentioned as occurring in the ore. Apparently little was done at the mine thereafter until 1891, when $38,646 production was reported. Heavy production began in 1894, but no details of output were revealed from then on. Estimates made at the time place the annual production at from $300,000 to $500,000, but F. C. Cullers, who was mill foreman at the property during the period of principal output, has estimated the total production at $6,000,000. Production continued until 1905 when an inclined depth of 1845 ft. was reached.

The heavy 'bull quartz' vein, which has the characteristic outcrop of a rough skeleton of quartz, stained by iron oxide from the weathering of the ankeritic portions, occurs between serpentine on the footwall and Calaveras (Carboniferous) formation on the hanging wall. It is as much as 70 ft. wide.

According to J. T. Lane, the ore was on the hanging wall side of this 'bull quartz' vein to a depth of 500 ft. where the ankerite cut out, having a rough wedge shape, with the edge down. From there

down the footwall was serpentine, which was rotten to a depth of two ft., and the hanging wall was black slate with heavy blue gouge. In places a thin layer of 'gray slate' was found between the vein and the black slate. The ore alternated with poor zones. In the earlier operations the gouge was left but later superintendents milled it as it carried as much as $2.50 a ton in gold. Lane states the ore-shoot varied in width from an average of 5 ft. to a maximum of 12 ft. and was about 150 ft. long. In the upper part of the mine the ore pitched south and for a time it was believed that it would pass under the Rawhide No. 2 claim, which has its north end-line only about 150 ft. from the Rawhide shaft but at 800 ft. in depth, the pitch changed to north. The greatest distance drifted north was about 1000 ft. Below the 1800-ft. level a winze was sunk 45 ft.

Mill of Senator Mining Co., at Quartz Mountain, Tuolumne County. Table Mountain skyline in background.

*Photo by Walter W. Bradley.*

The only work in late years has been the search for 'pockets' in shallow shafts north of the North shaft and between the Rawhide vein and the footwall serpentine. Here, two systems of stringers intersect and some 'pockets' have been found in the zone of intersection.

*Senator Mining Company* is working on what they state is the footwall vein on the Hitchcock claim, on the west side of Quartz Mountain and south of the App Mine. The ore-shoot was reported about worked out on the 100-ft. level in June, 1934. Work was going on at the 150-ft. level, where it was stated ore had been opened for 80 ft. on each side of the shaft. Six men, all interested as stockholders, were working the property. A single-drum hoist with 35-h.p. motor and a compressor with 50-h.p. motor are the principal items of the mine

plant. A mill of 10 stamps with a capacity of 40 to 50 tons crushes ore which is treated by flotation and concentration. (See flow sheet No. 10 under Metallurgy.) Dan Williams, superintendent.

*Tarantula Mine* (not to be confused with one of the same name northwest of the Rawhide) adjoins the Eagle-Shawmut on the north and is three miles southeast of Chinese Camp. It was worked only irregularly and in a small way until 1909, when a French company put a good plant, including 20 heavy stamps, on the property and then proceeded to prospect it. A crosscut adit was run 1200 ft. cutting a sulphide zone in the silicified schist at a depth of 400 ft. From this an internal shaft was sunk 640 ft. on 70° incline, and levels were turned every 100 ft. with short drifts. The adit, started from the southwest part of the Tarantula West Extension claim, crossing it and the Tarantula claim on the east. Nothing except low-grade altered schist mineralized with pyrite was found, so far as can be learned. A little of this was milled and the property has been idle ever since, though several times included in groups on which promotions have been based.

*Wise Claim* adjoins the Chileno on Jackass Hill. It is developed by two adits, which were 100 and 600 ft. long respectively in 1928. S. J. Davey, one of the owners, put up a mill of three 600-lb. stamps in 1927, which crushes two tons in eight hours through 40-mesh screen. It is operated by an old automobile engine.

Ore occurs in stringers in amphibolite schist, and 'pockets' are said to be found where vertical stringers and a system of others with flatter dip intersect.

## LIST OF MINES ON OR NEAR THE MOTHER LODE, TUOLUMNE COUNTY

| Name of mine | Location | | | To whom assessed | Elevation, feet | Area, acres | Bibliography |
|---|---|---|---|---|---|---|---|
| | Sec. | Twp. | Range | | | | |
| Alabama | 9 | 1 N. | 14 E. | Estate of Joseph D. Redding, Crocker Bldg. San Francisco | 1,650 | 19 | X, pp. 53, 741-742; XII, p. 298; XIII, p. 472; XIV, p. 136; XVIII, p. 99; XIX, pp. 19, 74, 145; XX, p. 19. |
| Alameda | 5 | 1 N. | 14 E. | Estate of Charles Fitzgerald, c/o Mrs. W F. Lyon, Jamestown et al | 1,600 | 20 | X, p. 55; XI, p. 508; XII, p. 299; XIII, p. 473; XIV, p. 136; XX, p. 12. |
| Albion Cons. | 2 | 1 S. | 14 E. | Albion Cons. G. Mining Co., c/o M. McCormick Co., 1432 N. El Dorado St., Stockton | | 67 | |
| Anti-Chinese | 32 | 2 N. | 14 E. | Heirs of L. T. Slonicker, c/o Mrs. A. S. Slonicker, 475 22d Ave., San Francisco | | 16 | |
| App | 22 | 1 N. | 14 E. | Sold to State | 1,680 | 40 | VIII, pp. 660-661; XII, p. 299; XIII, p. 473; XIV, pp. 136-137; XVII, pp. 482-483; XIX, p. 144; Bull. 18, pp. 130-131; See also Dutch. |
| Arbona | 32 | 2 N. | 14 E. | Calmas Mining Co., c/o C. M. Swerer, Route 1, Sonora | 1,400 | 25 | XIII, p. 473; XIV, p. 137; Bull. 18, p. 129. |
| Atlas and Soldiers Gulch | 30 | 2 N. | 14 E. | Mark Twain Mining Co., 511 Bank of Italy Bldg., Oakland | | 27 | XIII, pp. 473-474; XIV, pp. 137-138. |
| Bell | 30, 31 | 2 N. | 14 E. | Sutton & Rowe, c/o Fred Sutton, Sonora | 1,500 | 20 | XIII, p. 474; XIV, p. 138. |
| Belmont-Shawmut | 11, 12 | 1 S. | 14 E. | (See Eagle-Shawmut) | | | XVII, pp. 479-481; XVIII, pp. 99, 748-750; XIX, p. 19; Pre. Rep. 8, p. 39; XX, p. 19. |
| Big Chunk | 7 | 1 S. | 15 E. | Estate of T. F. McGovern, c/o F. R. McGovern, Santa Rosa | | 20 | |
| Blackfoot & Side Hill | 18 | 1 S. | 15 E. | | | 36 | (See Clio). |
| Black Hawk | 21, 28 | 1 S. | 15 E. | Helen L. Tallant, c/o Tallant & Tallant, 402 Mutual Savings Bank Bldg., 315 Montgomery St., San Francisco | | 21 | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Bower | 18 | 2 S. | 16 E. | B. A. Ogden | | 20 | |
| Bown | 25 | 2 N. | 13 E. | R. Minor, 1105 Sherman St., Alameda | | | XIV, p. 141; Bull. 18, p. 129. |
| Brown Bird | 2 | 1 S. | 14 E. | Wm. G. Fitzgerald, Jamestown | | 20 | |
| Buena Vista | 29, 31 | 2 N. | 14 E. | Mrs. M. R. Clement, 422 Pacific Ave., Piedmont | | 22 | |
| Cardinelle | | | | (See also Jackson Flat) | | | XIII, p. 475. |
| Chance | 21 | 1 S. | 15 E. | R. H. Goodwin, 579 25th St., Oakland | | 17 | |
| Chantreau | 7 | 1 N. | 14 E. | F. W. Street, Mrs. M. J. Hagman et al., c/o Mrs. M. J. Hagman, Jamestown | | 12 | |
| Chileno | 30 | 2 N. | 14 E. | Mark Twain Mining Co., a corp., 511 Bank of Italy Bldg., Oakland | | 16 | XIII, pp. 482-483; XIV, p. 142; XVIII, pp. 99-100; XIX, pp. 19, 144-145; Bull. 18, p. 129. |
| Clio | 18 | 1 S. | 15 E | Sold to State, June, 1926 | 900 | 115 | X, p. 47; XIII, pp. 475-476; XIV, p. 142; XVII, p. 481; XVIII, p. 100; XIX, p. 19; XX, p. 20, 182; Pre. Rep. 8, p. 39. |
| Cloudman | | | | (See Erin-go-Bragh) | | | XIII, p. 476. |
| Coffee-Mill | | | | | | | XIII, p. 476. |
| Combination | 32 | 2 N. | 14 E. | Tuolumne County Bank, c/o C. H. Segerstrom, Sonora | | 2 | XIII, p. 476. |
| Crystalline | 9 | 1 N. | 14 E. | Cecile Shafer, Jamestown | 1,500 | 51 | X, p. 742; XIII, pp. 477-479; XIV, p. 143; XVIII, p. 99; XIX, pp. 19, 74, 145; XX, p. 19. |
| Darrow | 5 | 1 N. | 14 E. | J. H. Darrow, Jamestown | 1,000 | 20 | XII, p. 301; XIII, p. 477; XIV, p. 143. |
| Dutch | 22, 23 | 1 N. | 14 E. | Sold to State for 1922 tax | 1,661 | 70 | X, p. 51; XI, p. 509; XII, p. 302; XIII, p. 477; XIV, pp. 145-146; XVII, p. 482; Bull. 18, p. 130. |
| Eagle Shawmut | 11, 12 | 1 S. | 15 E. | J. D. McCarty, Milton | 900 | 761 | X, p. 48; XIII, p. 477; XIV, p. 146; XVII, p. 479; XVIII, pp. 99, 748-750; XIX, p. 19; XX, p. 183; Bull. 18, pp. 132-133. |
| Erin-Go-Bragh & Cloudman | 27 | 1 N. | 14 E. | R. C. Bach, 1133 N. San Joaquin St., Stockton | | | XIII, p. 478; XX, p. 20. |
| Fleming | | | | | | | |
| Gladstone | 18 | 1 S. | 15 E. | Now part of Clio | | 18 | XI, p. 510; XIII, p. 478; XIV, p. 149. |
| Golden Key Cons. | 1, 12 | 2 S. | 15 E. | | | | |
| | 7 | 2 S. | 16 E. | | | | |
| Golden Nugget | 2 | 1 S. | 14 E. | Maud Twist, Tuolumne | | 19 | |
| Gold Ridge Mining Company | 1, 2 | 1 S. | 14 E. | c/o W. T. Jones, Jamestown | | 54 | |
| Golden Rule | | | | Part of Jumper | | | XIII, pp. 479-480. |
| Good Luck M. & M. Co | 12 | 1 S. | 14 E. | Good Luck Mining & M. Co., F. H. Tyler, Secy., 154 Davis St., San Francisco | | 156 | |

LIST OF MINES ON OR NEAR THE MOTHER LODE, TUOLUMNE COUNTY—Continued

| Name of mine | Location | | | To whom assessed | Elevation, feet | Area, acres | Bibliography |
|---|---|---|---|---|---|---|---|
| | Sec. | Twp. | Range | | | | |
| Grand Turk | 29 | 2 N. | 14 E. | A. W. Stinchfield & F. A. Mitchell, R.F.D. 1, Sonora | | 20 | |
| Gross Extension | 29, 30 | 2 N. | 14 E. | Fred Sutton, Sonora | | | |
| Harriman | 19, 30 | 1 S. | 15 E. | Harriman G. Mining & Milling Co., c/o L. W. Jefferson, Tribune Tower, Oakland | 900 | 55 | XVII, p. 485; XVIII, p. 100; XX, p. 20; Pre. Rep. 8, p. 40. |
| Harris | | | | | | | (See Crystalline). |
| Harvard | 16 | 1 N. | 14 E. | Thomas A. Ferguson, 615 Kohl Bldg., San Francisco | 1,390 | | X, p. 53; XIII, pp. 485, 493; XIV, pp. 149-151, 164; Bull. 18, p. 130. |
| Heslep | 22 | 1 N. | 14 E. | (See Dutch) | | | VIII, p. 660; XII, p. 299; XIII, p. 473; XIV, p. 136; XIX, p. 144; XX, p. 20. |
| Hitchcock | | | | | | | (See App). |
| Homestake | 12 | 1 S. | 14 E. | Homestake Mining Co. of Tuolumne, c/o Wm. Burchett, 239 Granite St., Pacific Grove | | | (See Rising Sun). |
| Hughes Cons. & Dyneta | 35, 26 | 1 S. | 15 E. | Green Cons. G. Mining Co., c/o Chas. S. Wheeler, 14 Montgomery St., San Francisco | | | |
| | 21 | 1 S. | 15 E. | | | 58 | |
| Imperial | 36 | 2 N. | 15 E. | | 990 | 153 | XIV, p. 152. |
| Isabella & Gem | 5 | 1 N. | 14 E. | John C. Faxon, et al., c/o Mrs. Clotilda Faxon-Bachman, Sonora | | 20 | |
| Jackson Flat & Parallel | 29 | 2 N. | 14 E. | George Rowe, R.F.D. 1, Sonora | | | |
| Jones-Tarantula | 2 | 1 S. | 14 E. | Henry T. Gage, Merchants National Bank Bldg., Los Angeles | 1,400 | 110 | XIV, p. 164. |
| Jumper & Golden Rule | 27, 35 | 1 N. | 14 E. | C. O'Shea and J. W. Schiffman, Jamestown | 1,360 | 64 | X, p. 50; XIII, p. 482; XIV, pp. 152-153; Bull. 18, pp. 131-132. |
| Justice | 19 | 2 N. | 14 E. | F. McArdle, Sonora | | 12 | |
| Kelly & Mother Lode | 18 | 1 S. | 15 E. | Peter M. Shaw, Chinese Camp | | 29 | |
| Knox & Boyle | | | | | | | (See Santa Isabel). |
| Last Chance, Free Lode, Charley Haley & Wilbur | 8, 9 | 1 S. | 15 E. | M. McCormick Mining Co., c/o Andrew McCormick, 1432 N. El Dorado St., Stockton | | 59 | (See McCormick). |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Lead & Tam O'Shanter, Toledo Cons., Buena Vista | 31, 32 | 2 N. | 14 E. | Mrs. M. R. Clement, 422 Pacific Ave., Piedmont | | 22 | X, p. 56; XIII, p. 484; XIV, p. 154 |
| Little Gem | 16 | 1 N. | 14 E. | W. T. Henslee, c/o E. C. Henslee, Jamestown | | 10 | X, p. 742; XIII, p. 484. |
| Lone Star | 2 | 1 S. | 14 E. | Asscssed to C. H. McWilliams, Jamestown | | 20 | |
| Lookout | | | | | | | (See Pena Blanco). |
| Mammoth | 12, 13 | 1 S. | 14 E. | (Part of Republican) | | | XIII, pp. 484-485. |
| Maryatt | 32 | 2 N. | 14 E. | Emmeline L. Bates, 465 California St., San Francisco | | 11 | |
| No. Ext. Maryatt | 29, 32 | 2 N. | 14 E. | J. W. Edwards, R.F.D. 1, Sonora | | 9 | |
| Mazeppa | 35 | 1 N. | 14 E. | Mazeppa Mine, Inc., c/o L. G. Baum, Jamestown | 1,250 | 43 | XI, pp. 509-510; XIII, p. 485; XIV, p. 156. |
| McAlpine | 18 | 2 S. | 16 E. | McAlpine Mines Co., c/o Miss Fannie W. McLean, 1829 Bancroft Way, Berkeley | 2,200 | | X, p. 43; XIII, p. 485; XIV, p. 156 |
| McArdle | 25 | 2 N. | 13 E. | T. H. McArdle, et al., c/o F. McArdle, Sonora | | 18 | |
| McCann | | | | R. P. Newcomb. 2300 Vine St., Berkeley | | | (See Harvard). |
| McCormick | 8, 9 | 1 S. | 15 E. | Andrew McCormick, 6 E. Main St., Stockton | 2,000 | 59 | XVII, p. 485; XX, p. 183; Pre. Rep. 8, pp. 40-41. |
| Miller & Holmes | | | | | | | (See Santa Ysabel Cons.). |
| Montreal Cons. | 30 | 2 S. | 14 E. | J. A. Gillis & F. L. Mitchell, R.F.D. 1, Sonora | | | |
| Mooney | 16 | 1 N. | 14 E. | R. P. Newcomb, 2300 Vine St., Berkeley | | | (See Harvard). |
| Mother Lode | | | | (See Kelly) | | | XIII, p. 486. |
| Mountain View Cons. | 31, 32 | 2 N. | 14 E. | Green Cons. Gold Mining Co., c/o Chas. S. Wheeler, 14 Montgomery St., San Francisco | | 35 | |
| Mountain View | 3 | 1 S. | 14 E. | Mrs. Maria Conselo, Heirs of W. G. Rowe, Chinese Camp, Jos. Sanguinetti, box 235, Sonora | | 21 | |
| New Era | | | | Part of Jumper | | | XI, p. 509; XIII, p. 487. |
| New Grand Turk | 29 | 2 N. | 14 E. | A. W. Stinchfield, Tuttletown | | 20 | |
| North Star, Black Warrior, Yellow Jacket | 21, 28 | 1 S. | 15 E. | John M. Babra, M. S. de Albergaria, 615 French Bank Bldg., San Francisco | | 56 | XIII, p. 487. |
| Norwegian | 19, 30 | 2 N. | 14 E. | H. A. and M. E. Hornlein, Room 306, 785 Market St., San Francisco | 1,200 | 39 | XIV, p. 157; Bull. 18, p. 129. |
| Nut Pine | 32 | 2 N. | 14 E. | Clarissa A. Trittenbach, R.F.D. 1, Sonora | | 10 | |
| Nyman Cons. | | | | | | 86 | (See Santa Ysabel Cons.) |
| O'Donnell | 15 | 1 N. | 14 E. | W., C. and C. E. Rudy, c/o W. Rudy, Route 1, box 210, Escalon | 1,150 | 20 | XIV, p. 157. |
| O. K. & No. Ext. | 32 | 2 N. | 14 E. | Tuolumne Co. Bank, c/o C. H. Segerstrom, Sonora | 1,300 | 40 | XI, p. 508; XII, p. 305; XIII, p. 487; XIV, p. 158. |

LIST OF MINES ON OR NEAR THE MOTHER LODE, TUOLUMNE COUNTY—Continued

| Name of mine | Location | | | To whom assessed | Elevation, feet | Area, acres | Bibliography |
|---|---|---|---|---|---|---|---|
| | Sec. | Twp. | Range | | | | |
| Omega Table Mountain | 9 | 1 N. | 14 E. | Peter A. Herivel, 7/8; Chas. E. Beyer, 1/8, c/o P. A. Herivel, 590 I. W. Hellman Bldg., Los Angeles | 1,200 | 89 | XIV, p. 158; XIX, pp. 19, 145; XX, p. 21. |
| Omega & W. Ext. | 2 | 1 S. | 14 E. | C. H. McWilliams, Jamestown | | | Sold June 29, 1929, for taxes. |
| Orcutt | | | | | | | (See Mammoth). |
| Pacific | 15 | 1 N. | 14 E. | R. P. Newcomb, 2300 Vine St., Berkeley | | | (See Harvard). |
| Patterson, Lennon | 29 | 2 N. | 14 E. | Deeded to the State | 1,500 | 45 | VIII, pp. 656-657; XII, p. 305; XIII, p. 488; XIV, p. 158; XVII p. 485; XVIII, pp. 100-101; XIX, p. 74; Pre. Rep. 8, p. 41. |
| Pena Blanco | | 1 N. | 14 E. | Ross & Chamberlain, c/o J. I. Ross, Redwood City | | 55 | XIII, p. 488; XIV, p. 159. |
| Pet Cossey | 20 | 1 S. | 15 E. | Estate of Anna A. Preston, c/o G. M. Booker Fletcher | | 14 | |
| Pine Tree | 30 | 2 N. | 14 E. | | | | XVIII, p. 99. |
| Prospect | 6 | 1 N. | 14 E. | D. Martin, Jamestown, F. and V. Martin | | | |
| Rappahannock | 5 | 1 N. | 14 E. | A. C. Mohr, Associated, Contra Costa County, Cal., et al. | 1,625 | 33 | XII, p. 306; XIII, p. 489; XIV, p. 159. |
| Rawhide | 4, 5 | 1 N. | 14 E. | Central Land Co., Patterson, Stanislaus Co., California | 1,670 | 291 | X, p. 54; XI, pp. 507-508; XII, p. 306; XIII, p. 489; XIV, pp. 159-160; XVIII, p. 101; Pre. Rep. 8, p. 41; Bull. 18, pp. 129-130. |
| | 8, 9 | 1 N. | 14 E. | | | | |
| Rawhide No. 2 | 9 | 1 N. | 14 E. | A. Hayward Estate, San Francisco | | | XII, p. 306; XIII, p. 489; XIV, p. 160. |
| Relief & Surplus | 29, 30 | 2 N. | 14 E. | Mayme Irene Jacobs and H. Helman, Gray, c/o Mrs. Myer Jacobs, 4719 Geary St., San Francisco | 2,900 | 20 | XIII, p. 489; XIV, p. 160. |
| | 32 | 2 N. | 14 E. | | | | |
| Republican | 12, 13 | 1 S. | 14 E. | Republican Mining and Dev. Co., Mills Bldg., San Francisco | 900 | 87 | X, p. 47; XIII, p. 489; XIV, p. 160; Bull. 18, pp. 133-134. |
| | 18 | 1 S. | 15 E. | | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Rice | | | | | | | XVIII, p. 99. |
| Riverside et al. | 17, 20<br>21 | 1 S.<br>1 S. | 15 E.<br>15 E. | D. E. Stratton, Chinese Camp | | 129 | |
| Santa Ysabel Cons. | 27 | 1 N. | 14 E. | Nyman Cons. Mines Co., 855 Howard St., San Francisco | 1,550 | 100 | X, p. 51; XII, p. 304; XIII, p. 490; XIV, p. 161; XVIII, p. 101; Bull. 18, p. 131. |
| Santissima | 30 | 2 N. | 14 E. | W. R. Gillis, ½; Jeanna Bluett, ½, R.F.D. 1, Sonora | | 9 | |
| Sarah Francis | | | | | | | (See Pena Blanco). |
| Shawmut et al. | 1, 2<br>11, 12<br>13 | 1 S.<br>1 S.<br>1 S. | 14 E.<br>14 E.<br>14 E. | J. D. McCarthy, Milton | | | (See Eagle Shawmut). |
| Shaw & Scholler | | | | | | | (See Street Mine). |
| Sobrante | 16 | 1 N. | 14 E. | R. P. Newcomb, 2300 Vine St., Berkeley | | | (See Harvard). |
| Stinchfied | | | | | | | (See Chileno). |
| Stocker | | | | | | | XVIII, p. 99. |
| Street | 29 | 2 N. | 14 E. | A. A. Smith, 1128 Broadway, Oakland | 1,500 | 20 | XIII, p. 492; XIV, p. 163. |
| Sweeney | 15, 22 | 1 N. | 14 E. | | | | XIII, p. 492; (see also Dutch-App) |
| Tam O'Shanter | 31, 32 | 2 N. | 14 E. | Mrs. M. R. Clement, 422 Pacific Ave., Piedmont | | | |
| Tarantula | 5<br>32 | 1 N.<br>2 N. | 14 E.<br>14 E. | Eric J. Segerstrom, Sonora | 1,600 | 18 | XIII, p. 493; XIV, p. 164. |
| Tarantula Hawk | 2 | 1 S. | 14 E. | C. H. McWilliams, Jamestown | | 8 | |
| Tarantula-Gold Ridge-Reitz Group | 2 | 1 S. | 14 E. | (See Jones-Tarantula) | | | XVII, pp. 485-486. |
| Toledo | 21 | 2 N. | 14 E. | Mrs. M. R. Clement, 422 Pacific Ave., Piedmont | 1,400 | | XIII, p. 493. |
| Trio | 16 | 1 N. | 14 E. | R. P. Newcomb, 2300 Vine St., Berkeley | | | (See Harvard). |
| Valparaiso | 29 | 2 N. | 14 E. | Walter Krause, Mrs. Geo. Crozier, Mrs. Jessie N. Lawson, 124 Roosevelt Ave., Redwood City | | | XIII, p. 493. |
| Victoria | 17 | 1 S. | 15 E. | Wm. Musso and G. B. Pietronave, c/o Golden Poppy Mining Co., Friedburger-Blodgett Bldg., Lodi | | 18 | |
| Vulture | 15, 16 | 1 N. | 14 E. | R. P. Newcomb, 2300 Vine St., Berkeley | | 11 | XIII, p. 493. |
| Whiskey Hill | | | | | | | (See Harvard). |
| Wickham | 32 | 2 N. | 14 E. | Margaret J. Hampton, Sonora | | 13 | |
| Willieta | 18, 19 | 1 S. | 15 E. | Estate of David Graham, c/o Marcel Cerf, Mills Bldg., San Francisco | 850 | 20 | XIII, p. 494; XIV, p. 166; Sold taxes, June 30, 1928. |
| Wilson & Means, Rice, Stoker, Gillis & Carrington | 30 | 2 N. | 14 E. | James A. Gillis, R.F.D. 1, Sonora | | 37 | |
| Wise | 29, 31<br>32 | 2 N.<br>2 N. | 14 E.<br>14 E. | Stephen Davey and A. A. Swerer, Tuttletown | 1,440 | 18 | XIV, p. 166. |

## MARIPOSA COUNTY

### Foreword

The mines in this county have never been in the district assigned to the Sacramento office of the Division of Mines, so that the writer's opportunities to visit them have been limited. In addition to this, few of the Mother Lode mines there have been active in the last 20 years, until the present revival in gold mining. Mariposa County has many mines besides those on the Mother Lode, and in late years these others have been producing most of the gold credited to the county. Much of the material herein on Mariposa County except in the few cases where the mines have lately become accessible for inspection, is therefore a compilation of information from the most reliable sources available.

### History—The Frémont Grant

Besides the conditions which have adversely affected gold mining everywhere since 1916 and until recently, the progress of mining in Mariposa County has been hampered since early days by the fact that some 14 miles in length out of a total of 25 miles on the Mother Lode has been under one ownership since 1856. The Frémont Grant, "Las Mariposas," containing 44,387 acres, was purchased from its Mexican owner in 1847 by Colonel John C. Frémont. As was usual with such grants, its boundaries had not been definitely established. Soon after the discovery of gold at Coloma in 1848, mining claims were taken up along the Mother Lode in Mariposa County, and mining started. When Frémont finally established his lines he swung them around so as to include the best section of the lode, which had for some time been in the possession of miners. There was then no U. S. mining law applying to California land under which miners could obtain patents. They were holding the claims under the local miners' rules and customs, which everywhere else in the State had public sanction and the force of law. In turn, the miners contended, and with good reason, that the Mexican law under which the grant had been made, and which was derived from Spanish law, was based on the severance of mining and surface rights and that the grant was only of the latter.

After lengthy disputes and some bloodshed, the miners were dispossessed following a court decision in 1859 that the U. S. patent issued to Frémont in 1856 carried the mineral rights. This grant extends from the Merced River opposite Bagby (formerly Benton Mills) to a line 2½ miles south of Mariposa. The most noted of the mines were the Josephine, Pine Tree, Princeton and Mariposa besides which many smaller ones have been productive. Under the Frémont ownership, important production began in 1860 and by May, 1863, had reached $101,000 a month. It was not long thereafter that the grant became the subject of one promotion scheme after another, and comparatively little gold was produced (considering the possibilities) until 1900, when a period of activity started. This ended in 1915 and

the mines of the grant have since been idle until Pacific Mining Company took a lease on the northern section of it in 1933. Now the prospect is that the Pine Tree, Josephine and adjoining mines may at last fulfill the hopes so long held for them.

Next to the Frémont Grant, the largest land holder in the mining section was the Cook Estate, at one time controlling some 20,000 acres, including most of the mines on the lode in the Coulterville district. The Merced Gold Mining Company took over these holdings about 1895 and worked the Mary Harrison, Louisa, Malvina, Potosi and other claims. Outside of these two large properties, the development of mines on the Mother Lode has been limited to shallow depths so far, the deepest being the Virginia, reaching about 1300 ft.

### Geology

This most southerly of the Mother Lode counties shows geologic characteristics similar to those noted in the northerly counties, but like El Dorado, its Mother Lode mines have not been developed much below 1000 ft. in depth. The lode enters the county from the north in the serpentine which flanks the Mariposa clay slates on the east and which extends for 3½ miles from the county-line nearly to Coulterville. The Peñon Blanco and Champion Mines are in that section. Near that town, where the serpentine pinches, the Louisa Mine lies at the eastern contact of slate and greenstone. At the western contact lie the Tyro, Potosi and Malvina. Two miles south of the town the serpentine outcrops again at the easterly contact of the Mariposa slate, separating it from the Calaveras beds. Here the Mary Harrison mine was quite extensively worked. The Virginia, another good producer is three miles south of Coulterville at the eastern contact of serpentine and Calaveras (Carboniferous) slate. From there south to Bagby the serpentine increases to a mile and a half in width and the Mariposa slates maintain a width of a mile. This section has so far had no large mines, but many pocket producers. Overlooking the river north of Bagby a group of claims have been worked in a limited way, showing more sulphide than is usual on the lode.

South of Merced River on the Frémont Grant, the serpentine pinches down to a long narrow dike along the east boundary of the Mariposa slate, the veins of the lode increase in number and the best mines occur. The Josephine and Pine Tree veins are close to the slate-serpentine contact, the former being in slate and the latter in the contact zone in the present workings. Near Bear Valley, however, the serpentine leaves the slate and fingers out in the hanging-wall greenstone. From there south the mines are in the slate. The great number of veins within the boundaries of Frémont Grant may be realized when it is remembered that the owners have a record of production from 73 different openings from nearly as many veins. (See tabulation.)

The southern termination of the Mother Lode is generally placed near the old town of Bridgeport about four miles south of Mariposa and near the south boundary of Frémont Grant. While the Jurassic slate extends from there nearly 30 miles into Madera County, it is separated into two bands one lying on each side of an immense mass

of granitic rock forming a part of the Sierra Nevada batholith. No important mines occur in these sections.

As in the other counties where the Mother Lode is associated with serpentine, immense outcrops of 'bull quartz' (silica, dolomite and ankerite) are found at several places. Peñon Blanco near the north county-line, and the May Rock near Bear Valley are the most remarkable, the latter being 82 ft. high. These great lenses reach a width of as much as 300 ft. and are similar to the masses farther north in Tuolumne County at Quartz Mountain, Shawmut and Whiskey Hill. As in those localities, such ore as may occur is not in the great vein itself but in veins on either side of it.

### Geography, Climate, Water, Power, Timber

Topographically, Mariposa County is similar to all of the other counties of the Mother Lode in its western portion. The Mother Lode crosses a series of interstream ridges separated by the canyons of streams which dissect the lower slopes of the Sierra Nevada as they flow toward San Joaquin Valley on the west. This section lacks the pleasing, park-like aspect of the lode in other counties, although farther to the east the typical Sierra Nevada growths of conifers are found. The county had a population of 2530 in 1930, or an average of less than two people to each square mile. Stock-raising and mining are the principal industries.

**Gold and Silver Production of Mariposa County, 1880–1933**

| Year | Gold, value | Silver, value | Year | Gold, value | Silver, value |
|---|---|---|---|---|---|
| 1880 | $150,017 | $1,300 | 1908 | $439,862 | $4,732 |
| 1881 | 200,000 | 1,200 | 1909 | 396,465 | 2,729 |
| 1882 | 250,000 | 4,000 | 1910 | 317,580 | 2,364 |
| 1883 | 220,000 | 3,000 | 1911 | 172,532 | 1,390 |
| 1884 | 180,000 | | 1912 | 160,541 | 6,796 |
| 1885 | 149,177 | 100 | 1913 | 171,034 | 7,430 |
| 1886 | 197,600 | | 1914 | 131,458 | 677 |
| 1887 | 187,165 | 96 | 1915 | 385,577 | 2,175 |
| 1888 | 175,000 | 250 | 1916 | 401,718 | 2,680 |
| 1889 | 145,819 | 210 | 1917 | 313,296 | 3,221 |
| 1890 | 124,265 | 22 | 1918 | 337,682 | 5,083 |
| 1891 | 84,414 | | 1919 | 253,392 | 4,139 |
| 1892 | 81,011 | 67 | 1920 | 261,830 | 4,705 |
| 1893 | 164,116 | 307 | 1921 | 331,295 | 5,251 |
| 1894 | 153,708 | 39 | 1922 | 218,571 | 3,301 |
| 1895 | 216,622 | 7 | 1923 | 141,883 | 1,735 |
| 1896 | 335,637 | 180 | 1924 | 182,099 | 1,608 |
| 1897 | 451,427 | 660 | 1925 | 192,810 | 1,758 |
| 1898 | 336,418 | 993 | 1926 | 182,313 | 1,518 |
| 1899 | 562,829 | 2,207 | 1927 | 183,805 | 1,376 |
| 1900 | 157,663 | 13,853 | 1928 | 120,568 | 2,199 |
| 1901 | 504,928 | 4,787 | 9129 | 91,052 | 651 |
| 1902 | 631,478 | 3,880 | 1930 | 58,985 | 318 |
| 1903 | 542,355 | 3,353 | 1931 | 88,600 | 551 |
| 1904 | 429,771 | 2,839 | 1932 | 169,627 | 636 |
| 1905 | 386,380 | 5,231 | 1933 | 254,663 | 1,112 |
| 1906 | 366,394 | 3,377 | | | |
| 1907 | 405,498 | 4,500 | Total values | $13,748,930 | $126,593 |

The treeless aspect of long stretches of the lode here is due largely to the extensive outcrops of serpentine and related rocks, and not to aridity, although there is a decrease in rainfall going south. The mean annual rainfall at Jacksonville, elevation 650 ft. and only a few miles north of the Mariposa County line on the lode, was 27.04 inches

over a 10-year period. At Mariposa, elevation 1932 ft. and on the Mother Lode near its southern end, the annual average precipitation over a period of 14 years was 30.72 inches. As elsewhere on this mineral belt, snow is a rarity and the summers are warm and almost completely devoid of rain.

The county supplies water to the city of San Francisco but has less in its western sections for local use than might be desired. The present lessee of the principal mines on the Frémont Grant is pumping water 1200 ft. vertically from Merced River for milling ore at a cost per ton of ore milled which is not excessive. Many other claims might be similarly supplied. Electric power is now available on or within a short distance of most of the Mother Lode. Timber is available from the region east of the lode, as in the nearby counties.

*Champion Mine* is on Blacks Creek a mile and a half northwest of Coulterville. From time to time, small tonnages of rich ore and pocket rock have been milled by lessees from this claim. No particularly rich rock has been reported as coming from the claim since 1911. In 1914 and 1918, a few hundred tons of medium to low-grade ore was milled. The vein is reported 6 to 12 ft. wide. There are two inclined shafts, one 200 ft. and the other 250 ft. deep, between which ore has been stoped.

*Louisa Mine* is on Maxwell Creek where the Mother Lode crosses it just south of Coulterville. The lode here, lying on the east side of the Mariposa slate, has a width of 300 ft. of the dolomitic rock or ankerite, colored in places by mariposite and everywhere interlaced by quartz stringers. Large quartz veins and lenses occur. One lens is about 300 ft. long and 20 ft. wide, but a shaft sunk on its footwall showed it thinning out. A vein 10 ft. to 20 ft. wide lies in the center of the lode, and a cross vein forms junctions with the lenses and veins running parallel to the lode. Greenstone forms the hanging wall and a strip or dike of similar rock lies between the ankerite lode and the Mariposa slate on the footwall.

There is a vertical shaft 375 ft. deep, with 275 ft. of drifting on the 100-ft. level, 75 ft. on 200-ft. level and 500 ft. of drifting on the 300 ft. level. There are also said to be crosscuts totaling 775 ft. and winzes totaling 600 ft. as well as an air shaft 150 ft. deep. This work was done by Merced Gold Mining Company, 1895 to 1900 and ore was taken to the Potosi mill. There are no separate figures at hand for the production of the Louisa.

*Malvina Group* is a mile west of Coulterville in Sec. 4, T. 3 S., R. 16 E. on the west side of the Mariposa slate. These claims were located in 1852. By 1867, Malvina No. 1 claim had been opened to a depth of 440 ft. by an adit and the lode had been followed 330 ft. It is stated that 3000 tons of ore mined above this level yielded an average of $7 a ton, and that the average width of the vein was 10 ft. There is a strip of greenstone on the hanging-wall side interbedded with the Mariposa slate, which forms the footwall. The Potosi mine is on the north and the Tyro on the south. These claims formerly were part of the holdings of the Cook Estate, at one time the second largest landowner in the county. In 1895 all their mines passed into the

hands of Merced Gold Mining Company and ore from the different workings was crushed in a mill on the Potosi.

The results of two years' work by this company on the Malvina were reported to be disappointing. In August, 1897, they removed the machinery and the claims have lain idle ever since until early in 1934, when plans for reopening were announced.

The work done by the former operators includes a 3-compartment vertical shaft sunk in the hanging-wall slates to a depth of 1000 ft. with levels at 200, 400, 600, 900 and 1000 ft. A total of 2287 ft. of drifts are reported, with some drifting on all but the bottom level. There was also an incline 875 ft. deep and a tunnel about 3000 ft. long for hauling ore to the Potosi mill.

*Mariposa Mine* at the south side of Mariposa was discovered in the spring of 1849 by Kit Carson, the famous scout, and two associates. In July of that year, Palmer, Cook & Company were running a stamp mill on ore from this mine. This was possibly the first stamp mill in the State; but it was not complete, as the pulp after stamping had to be washed in rockers to save the gold. It was one of the best known of the gold quartz mines of early days and had a reported production of $200,000 before Frémont succeeded in ousting the original owners when his title to the mineral rights on the grant was confirmed in 1859. Thereafter, it was operated under lease by Barnett until 1864. He sorted the ore, and made a success of the mine. In 1864, it was worked by the stock company that had taken over the grant, and although the ore was claimed to average $25 a ton, no profit was reported from a gross yield of $84,948 that year. Soon after, the grade of ore fell off to $10 or $11 a ton and the mine was closed in October, 1870, after three months milling with 25 stamps gave an average of $9.98 a ton, scarcely enough, it was stated, to pay expenses. Up to that time, it was claimed to have had an output of $1,500,000 to a depth of 275 ft. and had had five mills.

In 1898, when control of the grant changed hands, this was one of the mines reopened. In sinking the new inclined shaft, it was found the vein passed into the hanging-wall greenstone at about 400 ft. depth. Some good ore was found to have been left on the 275-ft. level in the old workings because it was apparently too hard for hand drilling. Between December 20, 1900, and the end of 1915, the mine produced 112,379 tons which yielded $693,205. Work reached a depth of 1550 ft.

If the old reports, particularly that of J. Ross Browne for 1868, are accurate, the Mariposa outcrop was extremely rich, as attested by the extensive placer work below it. The vein, which strikes N. 70° W. splits near the old shaft, with a fork going N. 50° W. These branches are said to have contained rich gold pockets, and were worked in the early days in the usual manner of 'pocket' mines. According to a contemporary report, "They have not been worked upon any regular system, but have been much burrowed into by different parties in quest of these rich pockets." The main vein southeast of the split was evidently of more uniform gold content. It was here, some distance southeast of the old shaft, that the new one was sunk. It had eight levels with drifts as follows:

| Level Depths (inclined) Feet | East Drift Feet | West Drift Feet |
|---|---|---|
| 275 | 390 | 400 |
| 475 | 400 | 637 |
| 625 | 700 | 600 |
| 800 | 322 | 410 |
| 970 | 396 | 412 |
| 1200 | 250 | 400 |
| 1400 | 60 | 50 |
| 1550 | 200 | 130 |

Ore is reported stoped out above the 800 ft. level. The walls are greenstone (diorite porphyrite), and the vein is said to vary in width from a seam to 12 ft. The tabulation of production herewith shows the best year's results were had in 1901, when 21,557 tons averaged $10.25 a ton recovery. In the lower half of the mine (so far as opened) assay values dropped quite low.

*Mary Harrison Mine* is two miles south of Coulterville on the eastern part of the Mother Lode near the contact of the Mariposa slate and serpentine. Previous to 1867 it had been opened by an incline 240 ft. long and an ore-shoot reported 200 ft. long had been stoped to an inclined depth of 150 ft. When this mine, with the others of the Cook Estate, passed to Merced Gold Mining Company in 1895, it had an inclined shaft 400 ft. deep. It became the most important of the company's mines. Ore was opened on the 400-ft. level for a reported length of 300 ft. While this was being mined a new vertical shaft was driven some 750 ft. from the old shaft. The attempt to mine through the old shaft and transfer ore for hoisting through the new one made operations expensive and slow, and the output per man appears to have been only a little over 1 ton per shift. The vertical shaft finally reached a depth of 1200 ft. and the incline of 800 ft. Levels were opened at 100-ft. intervals and some 5000 ft. of drifts were driven. Operation ceased about 1903, and all surface plant has been removed or burned.

The principal vein in this mine was on the footwall side of the dolomitic complex common along the lode near serpentine; Storms called both walls "diabase," but dumps and outcrops show the characteristic mariposite-stained ankerite. Old company reports released at the time of operations, and giving about the only information available locally, indicate an ore-shoot 300 ft. long from the 400-ft. to 700-ft. level. It was reported 10 ft. wide in the upper part, decreasing to about 3 ft. on the 600-ft. level, and giving there and on the 700-ft. level very erratic assays, with some rich ore, but mill returns in 1897 were about $5 a ton. The mine was represented then as containing about 60,000 tons of ore that would pay a profit of about $1 a ton. The record of production is not complete but from 1898 to 1903, inclusive, the yield was evidently between $330,000 and $400,000.

*Peñon Blanco Mine* was the first claim in the county for which patent was sought under the mining law of 1866, which did not limit the length of claims. As a result, this claim is 5850 ft. long. North Peñon Blanco claim on the north, and Old Judge and South Judge claims on the south, give the group a total length of nearly two miles

on the lode, beginning close to the Tuolumne County line. The claims are along the large lens of serpentine which traverses the lode in this region, and which, a little farther north, has entirely displaced the Mariposa slate.

Peñon Blanco is one of those prominent ridges of quartz and dolomitic rock common in such sections. At the south end of Peñon Blanco claim the lode formation is 250 to 300 ft. wide, and composed of this dolomitic rock traversed by numerous quartz stringers. Lenses or veins of massive quartz of all sizes occur in this formation. In this claim, such a quartz vein occurs on the east side of the lode. Only a little work was done on the mine in early days, and no record of output, if any, remains. Some 34 years ago, Oro Rico Mines Company was organized and began work. The vein was reached through a crosscut 600 ft. long, giving a depth of 320 ft. below the outcrop, and 1000 ft. or more of drifts are reported as having been run on the vein. A winze was sunk 350 ft. deep from the floor of the west drift, and four levels were turned, but the amount of work done on these is unknown. The company worked until 1912 or 1913, since when the property has been tied up by litigation and disputes. Vein is reported 3 to 7 ft. wide.

A 20-stamp mill was built by this company but only a little ore was milled before closing.

*Pine Tree* and *Josephine Mines* are on the Mariposa Grant and are the principal mines in the grant holdings under lease to *Pacific Mining Company* which extend from the Merced River at Bagby to the north line of T. 5 S., R. 17 E., along the Mother Lode. The *River Tunnel* and *Queen Specimen Mines,* less noted than the above, are also included.

The Pine Tree and Josephine were among the earliest mines worked on the Mother Lode and their romantic histories have often been alluded to in past reports. Although J. Ross Browne, Special U. S. Commissioner for collection of mining statistics, stated in 1866 that these two mines had then been worked for nearly 16 years, he was unable to give any details of production before 1860, other than to say that the gross production had been, undoubtedly, very large. Through the decision of the courts in 1859, fully confirming the title of John C. Frémont to the grant "Las Mariposas," including mineral rights, these mines passed from the hands of previous operators and work was begun by the Frémont interests. From June, 1860, to May, 1863, the output of the Pine Tree and Josephine was $350,000 from 45,000 tons of ore. In 1864, the Pine Tree yielded $67,940 according to Browne and the Josephine lay idle, having been temporarily abandoned because the ore did not pay $8 a ton in the Benton mill, which was known to be a very poor gold saver. Experiments with new methods of milling were carried on for some time thereafter. The production record is fragmentary; for the fiscal year 1869–1870, the production of the Josephine, Pine Tree and Mariposa mines was about $170,000. The Frémont Grant property had become the subject of stock-selling schemes, debts had piled up and one company succeeded another for several years. During this time, considerable work appears to have been done, including the starting of the River Tunnel from near the level of Merced River and running southward. It finally

reached a length of 3300 ft. with its face under the Queen Specimen and a depth of 1200 ft. below the present workings. There were also numerous shorter adits driven at higher elevations.

In 1887, the Mariposa Commercial & Mining Company was formed by Hayward, Hobart, Mackay, Flood and associates and took over the title which had been purchased by Donahue at sheriff's sale. From 1888 to 1898, inclusive, only about $10,000 is recorded as coming from the mines on the grant. In 1898 there was a change in stock ownership and British capital was supplied for reopening the mines under the management of John H. Mackenzie. The itemized tabulation of production of the mines on the Frémont Grant (see, *post*) from 1900 to October 31, 1915, shows that the Pine Tree and Josephine produced during that period 20,968 tons which yielded $371,748 giving an average recovery of $12.40 a ton. Since 1915, the combined production of the mines on the grant has been small, usually amounting to only a few thousand dollars a year from the scattered operations of lessees, until the north end of the grant was taken over in 1933 by Pacific Mining Company.

#### Mine Workings

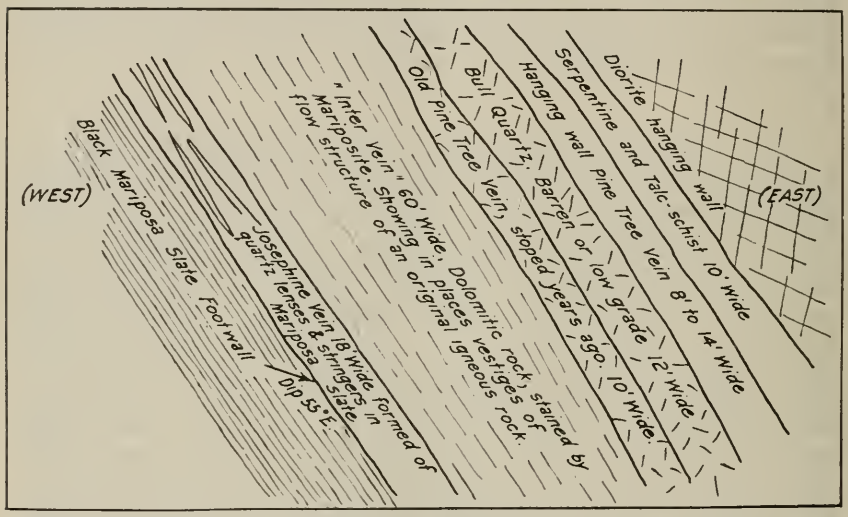
The work of this company has been principally sampling and developing the large blocks of low-grade ore in the Pine Tree-Josephine area particularly. A mill with a daily capacity of about 100 tons has been built and milling has been going on steadily during the past two years. A total of 2300 ft. along the strike has been sampled through the following old adits, which had been driven by previous operators and are in the order named, north to south: Jacinto, December, April, September, English Trail and 7 others which cross the lode at vertical depths of from 75 to 300 ft. below the surface. The New Pine Tree Tunnel, from which hundreds of samples have been taken and many thousand tons of ore already milled, is north of those named and about 224 ft. vertically below them. It was 1200 ft. long in June, 1934, and had then to be driven about 1200 ft. farther south to connect with No. 1 crosscut workings connecting with an old adit 560 ft. long on the Josephine vein from the September adit. The deepest new work is a winze being sunk from the New Pine Tree Tunnel on the Pine Tree vein, and this was 433 ft. deep or 783 ft. below the outcrop in June. In the work directed by Mackenzie about 1900 a winze was sunk to a depth of 500 ft. on the Josephine vein below the floor of the English Trail adit. He ran the 300-ft. level from this 350 ft. south and 240 ft. north. This showed material similar in average grade to much of that sampled in the blocks above. It can be entered through the New Pine Tree Tunnel workings.

The work being done is for the purpose of testing the possibilities of the property and the character of ores and their amenability to treatment, with a view of initiating operations on a large scale if results are satisfactory. At the time of visit in June the work appeared to be moving successfully. Over 30,000 tons of ore had been milled, the larger part coming from the Pine Tree vein in the Josephine mine. The hanging-wall Pine Tree vein and Josephine vein had also given good results with higher gold content than the average obtained. If the work is carried through according to present tentative plans, Mari-

posa County will have one of the largest operations on the Mother Lode, under the direction of a capable and well-financed company. Mining by block-caving after stripping with a power shovel is contemplated.

### Geology

The sketch showing a cross-section of the veins in the New Pine Tunnel at crosscuts No. 2 East and No. 3 West gives an idea of the conditions found in the sections sampled. Much has been written in the past about the geology of the two mines which were formerly worked separately. The two veins are separated by a varying width of the complex mixture so familiar on the lode in the vicinity of serpentine—ankerite, quartz, mariposite and remnants of igneous rocks showing flow structure in places. In the section shown, this complex is 60 ft. wide. The present operators call it the Inter vein.


(WEST)
(EAST)
Black Mariposa slate Footwall
Josephine vein 18' wide formed of quartz lenses & stringers in Mariposa slate. Dip 55° E.
"Inter vein" 60' wide. Showing in places mariposite & flow structure
Old Pine Tree Vein. Dolomitic rock stained by stringers of vein quartz, stoped years ago.
Bull Quartz
Hanging wall pine Tree vein 8' to 14' wide
Barren or low grade 12' wide.
Serpentine and talc-schist 10' wide
Diorite hanging wall

Section across veins in New Pine Tree Tunnel, looking north, near crosscuts No. 2 East and No. 3 West.

The total width of the lode here from the black Mariposa slate footwall to the greenstone hanging wall is 125 ft. The Josephine vein is a typical one of stringers and lenses of quartz in the black slate, and is here 18 ft. wide. The black-slate footwall dips 55° east. The Inter vein forms the hanging wall of the Josephine vein in the workings visited; in other parts of the property it varies greatly in width.

The old Pine Tree vein, from which the earlier operators produced good ore, lies on the immediate hanging wall of the Inter vein. The old work on this vein is reported to have reached a depth of 500 ft. on the dip, and a length of 500 ft. on the strike is said to have been stoped. Its immediate hanging wall is a 'bull quartz' vein 12 ft. thick. Then comes the hanging-wall Pine Tree vein, 8 ft. to 14 ft. wide, said to be a new development from which ore recently milled has yielded very well. On this, and separating it from the greenstone of the main hanging wall is a layer of serpentine and talc schist of varying thickness, here 10 ft.

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| From | Location Sec. | T. | R. | Remarks | 1900 Tons | 1900 Bullion value | 1900 Per ton | 1901 Tons | 1901 Bullion value | 1901 Per ton | 1902 Tons | 1902 Bullion value | 1902 Per ton | 1903 Tons | 1903 Bullion value | 1903 Per ton | 1904 Tons | 1904 Bullion value | 1904 Per ton | 1905 Tons | 1905 Bullion value | 1905 Per ton | 1906 Tons | 1906 Bullion value | 1906 Per ton | 1907 Tons | 1907 Bullion value | 1907 Per ton | 1908 Tons | 1908 Bullion value | 1908 Per ton |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ahee | 17 | 5 S. | 17 E. | | | | | 228 25 | $3,895 92 | $16 93 | 460 40 | $4,268 29 | $8 88 | 63 37 | $1,824 09 | $24 65 | | | | | | | | | | | | 12 20 | $154 37 | $11 01 |
| Apalmario | 22 | 3 S. | 18 E | ½ mi. W. of Mariposa | | | | | | | | | | | | | | | | | | | | | | | | 9 00 | 126 20 | 14 03 |
| Arkansas Flat | 31 | 3 S. | 18 E. | | | | | | | | | | | | | | | | | | | | 8 75 | $154 46 | $17 78 | Pocket | $494 69 | | Pocket | 114 26 | |
| Augua Fria Canyon | 20 | 2 S. | 18 E | 4" Vein on W. side of Canyon about ½ mi. N. of Damnie | 4 16 | $76 74 | $18 35 | | | | | | | | | | | | | | | | | | | | | 12 55 | 131 07 | 10 37 |
| Aul & Anderson | 30 | 5 S. | 17 E. | Near Turner Mine | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Baker Prospect | 18 | 5 S. | 18 E. | Parallel Princeton—2000' SW. | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Barrel Springs | 22 | 3 S. | 17 E. | | | | | | | | | | | | | | | | | 47 55 | $708 88 | $14 89 | | | | | | | | |
| Bear Valley Mountain | 29 | 4 S. | 17 E. | | | | | | | | | | | | | | | | | 31 00 | 280 59 | 9 46 | | | | | | | | |
| Big Oak | 4 | 5 S. | 17 E. | | | | | 8 42 | 171 34 | 20 95 | 26 52 | 437 92 | 16 53 | | | | 18 36 | $454 51 | $24 46 | 8 46 | 174 52 | 20 92 | 14 82 | 151 90 | 10 25 | | | | | | |
| Black Spring | 16 | 5 S. | 18 E. | Upper Augua Fria | | | | | | | | | | | | | | | | 7 93 | 282 75 | 36 55 | 8 89 | 105 93 | 12 93 | | | | | | |
| Boarding House Vein | 18 | 5 S. | 18 E. | | | | | | | | 43 00 | 1,115 67 | 25 94 | 90 09 | 944 53 | 10 40 | | | | | | | | | | | | | | |
| Buckeye Mine | 3 | 6 S. | 18 E. | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Champion | 16 | 5 S. | 17 E. | | | | | | | | | | | 13 88 | 332 75 | 23 97 | | | | | | | | | | | | | | |
| Chesnweth | 29 | 4 S. | 17 E. | | | | | 39 72 | 652 25 | 17 19 | | | | | | | | | | | | | | | | | | | | |
| Dunn | 32 | 3 S. | 18 E. | | | | | | | | | | | 10 12 | 473 61 | 46 79 | | | | | | | | | | | | | | |
| Elizabeth | 5 | 5 S. | 17 E. | | | | | | | | | | | | | | | | | 33 00 | 425 10 | 12 85 | 50 41 | 1,017 83 | 33 93 | 39 40 | 385 74 | $10 60 | 32 80 | 644 75 | 19 64 |
| Evans | 9 | 4 S. | 17 E. | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Fournier Shaft | 18 | 5 S. | 18 E. | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| French Camp | 4 | 5 S | 18 E. | | | | | | | | | | | | | | | | | | | | | | | | | 8 00 | 160 87 | 20 00 |
| French Mine | 9 | 4 S | 17 E | | | | | | | | | | | 8 51 | 376 93 | 44 16 | | | | | | | | | | | | | | |
| Near French Mine | 9 | 4 S. | 17 E | ½ mi. W. of French Mine | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Gardner Vein | 18 | 5 S. | 18 E. | Parallel Princeton—1000' SW. | | | | 24 10 | 132 93 | 5 67 | 64 32 | 603 23 | 9 38 | | | | | | | | | | | | | | | | | | |
| Gilmore Vein | 34 & 35 | 5 S | 16 E | | 51 17 | $28 38 | 16 38 | 12 45 | 317 86 | 25 53 | | | | | | | | | | | | | | | | | | | | |
| Gold Bug | 4 | 5 S. | 17 E | | | | | 3 28 | 853 74 | 262 17 | 21 30 | 873 79 | 41 00 | | | | | | | | | | | | | | | | | |
| Gold Hill | 32 | 3 S. | 17 E. | See Mann Garden | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Green Gulch | 12 | 5 S. | 17 E. | | | | | 146 87 | 3,030 83 | 20 36 | 97 60 | 1,291 55 | 13 23 | 34 22 | 471 25 | 12 77 | 69 17 | 1,203 16 | 18 53 | 54 35 | 937 93 | 15 94 | | | | 750 00 | 10,215 10 | 13 62 | 2,210 60 | 31,960 86 | 14 46 |
| Green Gulch Extension | 13 | 5 S. | 17 E | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Grizzly Gulch | 14 | 5 S. | 18 E. | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Guadaloupe | 32 | 5 S. | 18 E. | | | | | | | | | | | | | | 18 90 | 530 12 | 28 03 | 12 14 | 329 01 | 27 08 | | | | | | | | |
| Hacker Mine | 21 | 5 S. | 18 E. | | | | | | | | | | | | | | | | | | | | 5 22 | 331 50 | 33 30 | | | | Pocket | 95 47 | |
| Hardscrabble | 11 | 5 S. | 17 E | | | | | | | | | | | | | | | | | | | | | | | | | | 8 00 | 555 55 | 85 20 |
| Kangaroo | 4 | 5 S. | 17 E. | | | | | | | | | | | 9 28 | 231 98 | 25 00 | 7 56 | 69 86 | 9 24 | | | | | | | | | | | |
| Lewis Brothers | | | | | | | | | | | | | | 5 52 | 162 61 | 29 35 | | | | | | | | | | | | | | |
| Long Mary | 17 | 5 S. | 17 E. | | 192 36 | 1,842 13 | 18 00 | 8 80 | 105 86 | 12 30 | | | | | | | | | | | | | | | | | | | | |
| Louis | 11 | 5 S. | 17 E. | | 93 11 | 5,383 23 | 57 81 | 765 54 | 22,422 46 | 29 29 | 943 60 | 18,116 18 | 19 20 | 906 00 | 22,550 57 | 23 34 | 1,110 64 | 17,051 26 | 15 35 | 47 53 | 816 71 | 17 01 | | | | | | | | |
| Louis Extension | 11 | 5 S. | 17 E | 3000 N.W. | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Ludwig Vein | 18 | 5 S. | 18 E | | 11 00 | 532 79 | 48 44 | | | | 182 92 | 2,665 10 | 14 59 | 314 04 | 3,415 [illegible] | 10 87 | 119 10 | 2,085 74 | 17 5 | 49 14 | 749 87 | | | | | | | | | |
| Mariposa | 23 | 3 S. | 18 E. | | 313 66 | 6,328 07 | 20 17 | 21,557 00 | 220,905 20 | 10 25 | 25,426 00 | 195,740 74 | 7 90 | 26,223 00 | 116,403 26 | 4 44 | 27,303 00 | 97,341 26 | 3 56 | 6,851 00 | 20,077 04 | | 15 95 | 919 44 | 58 64 | 8 00 | 381 46 | 45 18 | 553 00 | 3,045 54 | 5 51 |
| Mann Garden | 12 | 3 S. | 17 E. | | 49 25 | 221 54 | 4 50 | | | | | | | | | | | | | 55 15 | 906 20 | | 3 20 | 50 20 | 15 33 | 6 00 | 53 50 | 10 59 | | | |
| Mexican Mine | 28 | 4 S | 17 E. | Near Bear Valley | | | | | | | | | | | | | | | | | | | | | | | | | Pocket | 62 00 | |
| Missouri Gulch | 14 | 5 S. | 18 E. | | | | | | | | | | | 7 33 | 54 58 | 7 49 | | | | | | | | | | | | | | |
| Mocking Bird | 30 | 3 S. | 18 E. | | | | | 8 16 | 209 23 | 25 64 | 35 31 | 875 79 | 24 81 | | | | 11 98 | 351 81 | 29 45 | | | | 11 32 | 310 23 | 27 40 | 10 70 | 261 61 | 24 45 | 10 00 | 126 27 | 12 63 |
| Molly Gibson | 18 | 5 S. | 18 E | See Gardner Vein | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Mount Ophir | 13 | 5 S. | 17 E. | | | | | 159 25 | 3,840 74 | 16 79 | 096 93 | 6,460 71 | 10 85 | 334 81 | 5,749 14 | 7 17 | 285 94 | 6,575 41 | 22 37 | 147 09 | 1,961 08 | 12 95 | | | | 103 72 | 235 42 | 2 27 | 10 00 | 80 18 | 8 02 |
| Mount Ophir Foot Wall | 12 | 5 S. | 17 E. | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Mountain View | 11 | 5 S. | 17 E | | 68 55 | 1,078 40 | 24 44 | 34 50 | 1,879 59 | 55 11 | | | | 22 60 | 1,356 43 | 60 02 | | | | | | | | | | | | | | |
| Oak Springs | 9 | 5 S. | 18 E | | 7 10 | 396 57 | 51 53 | 24 96 | 540 38 | 21 67 | | | | 10 89 | 241 87 | 22 20 | 11 40 | 250 00 | 21 92 | 17 04 | 216 02 | 12 69 | 5 42 | 75 10 | 21 94 | | | | | |
| Oiler Vein | 29 | 4 S. | 17 E. | Bear Valley Mountain | | | | | | | 59 10 | 756 78 | 12 80 | | | | | | | | | | | | | | | | | |
| Ono Mine | 30 | 4 S. | 17 E. | | | | | | | | | | | | | | | | | | | | 7 85 | 164 62 | 20 90 | | | | | |
| Paine's Shaft | 24 | 5 S. | 18 E | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Pendola Garden | 10 | 5 S. | 17 E | | | | | | | | | | | | | | | | | | | | | | | | | | 17 00 | 278 58 | 16 39 |
| Phoebe Shaft | 18 | 5 S. | 18 E | | | | | | | | | | | | | | | | | | | | | | | | | | 130 00 | 272 50 | 2 10 |
| Pine Tree & Josephine | 5, 16 | 4 S. | 17 E. | | 125 60 | 531 51 | 4 23 | 133 34 | 1,127 33 | 9 05 | 278 13 | 257 94 | 93 | 1 46 | 12 17 | 8 33 | 99 14 | 745 93 | 7 52 | 1,608 80 | 13,473 84 | 8 38 | 4,331 10 | 34,464 01 | 8 38 | 3,586 25 | 50,837 50 | 15 38 | 2,998 50 | 54,434 93 | 18 16 |
| Pine Tree & Jos. Extension | 16 | 4 S. | 17 E | 1000' S. of Blow Out | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Porphry Hill | 30 | 3 S. | 18 E | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Princeton | 18 | 5 S. | 18 E | | 2,086 75 | 7,935 74 | 3 80 | 18,594 00 | 111,019 70 | 5 66 | 38,606 00 | 179,677 73 | 4 64 | 74,292 00 | 254,028 99 | 3 42 | 58,160 90 | 167,568 49 | 2 88 | 67,771 12 | 227,830 63 | 3 36 | 48,316 00 | 126,568 13 | 2 62 | 21,826 00 | 85,600 24 | 3 72 | 16,744 00 | 48,130 41 | 2 88 |
| Princeton Vein Outcrop | 12 | 5 S. | 18 E. | 2000' NW. | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Phillips Dump (Princeton) | 18 | 5 S. | 18 E. | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Queen Specimen | 8 | 4 S. | 17 E | | | | | | | | | | | | | | | | | | | | | | | | | | 475 00 | 3,242 21 | 6 84 |
| Reola Flat | 31 | 4 S. | 17 E | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Reynolds Vein | 11 | 5 S. | 17 E. | Parallel Mountain View—500' NE. | 130 02 | 1,750 38 | 13 40 | | | | | | | | | | 17 99 | 98 37 | 5 36 | | | | 20 62 | 271 20 | 13 18 | | | | | |
| River Tunnel | 5 | 4 S. | 17 E | | | | | | | | | | | | | | 1,114 00 | 780 52 | 70 | 796 60 | 794 70 | 1 00 | | | | | | | | |
| Roosevelt | 9 | 5 S. | 16 E | | | | | | | | | | | | | | | | | 7 30 | 66 87 | 9 16 | 7 00 | 92 63 | 13 10 | | | | | |
| Scorpion | 20 | 4 S. | 17 E. | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Simpson Vein | 30 | 5 S. | 16 E | | | | | | | | 46 74 | 341 21 | 7 30 | | | | | | | | | | | | | | | | | |
| Stockton Crock | 24 | 5 S. | 16 E. | | | | | | | | 9 60 | 145 24 | 22 50 | 5 93 | 172 18 | 30 50 | | | | | | | | | | | | | | |
| Stockton Cr. Tunnel | 24 | 5 S. | 16 E | | | | | | | | 141 90 | 3,702 72 | 26 10 | 159 50 | 3,721 16 | 18 10 | | | | | | | 25 44 | 598 70 | 23 33 | | | | 10 00 | 135 05 | 13 50 |
| Texas Mine | 30 | 3 S. | 18 E | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Thomas & Soumon | 17 | 3 S. | 18 E. | | | | | | | | 183 50 | 2,614 89 | 14 24 | 2 04 | 74 03 | 36 73 | | | | | | | | | | | | | | |
| Turner Mine | 24 & 30 | 5 S. & 5 S. | 17 E. & 18 E. | | | | | | | | | | | 22 37 | 240 65 | 10 78 | | | | | | | | | | | | | | |
| Watson Vein | 4 | 5 S. | 16 E | | | | | | | | 12 27 | 725 08 | 59 06 | 93 79 | 1,324 21 | 14 12 | | | | | | | 4 30 | 125 91 | 27 96 | | | | | |
| Wet Branch | 17 | 5 S. | 18 E | | | | | | | | | | | 16 51 | 208 00 | 31 13 | | | | 20 37 | 172 64 | 8 39 | | | | | | | | |
| Wildcat | 16 | 5 S. | 17 E. | ½ mi. E. of Long Mary | | | | 57 90 | 387 55 | 6 69 | | | | | | | | | | | | | | | | | | | 12 00 | 44 95 | 3 75 |
| Mucel Scrape | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 12 20 | 132 86 | 10 89 |
| Totals | | | | | 5,044 76 | $37,435 46 | $9 02 | 40,353 75 | $387,874 13 | $9 61 | 67,838 80 | $424,575 91 | $6 26 | 197,643 13 | $411,852 60 | $4 08 | 88,347 04 | $294,902 44 | $3 34 | 77,643 87 | $271,258 24 | $3 49 | 82,842 22 | $193,700 86 | $3 19 | 28,006 00 | $153,054 08 | $5 49 | 23,352 15 | $145,953 09 | $6 25 |



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County, 1900, to October 31, 1915

| 1908 | | | 1909 | | | 1910 | | | 1911 | | | 1912 | | | 1913 | | | Jan. 1 to June 30, 1914 | | | July 1, 1914 to Oct. 31, 1915 | | | Total | | | From |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Tons | Bullion value | Per ton | Tons | Bullion value | Per ton | Tons | Bullion value | Per ton | Tons | Bullion value | Per ton | Tons | Bullion value | Per ton | Tons | Bullion value | Per ton | Tons | Bullion value | Per ton | Tons | Bullion value | Per ton | Tons | Bullion value | Per ton | |
| 12 20 | $134 37 | $11 01 | | | | | | | | | | | | | | | | | | | | | | 764 22 | $9,702 58 | $12 80 | Alice |
| 9 00 | 126 29 | 14 03 | | | | | | | | | | | | | | | | | | | | | | 9 00 | 126 29 | 14 03 | Apolinaris |
| Pocket | 114 26 | | | | | | | | Pockets | $280 50 | | | | | | | | | | | | | | 8 75 | 953 91 | 109 02 | Arkansas Flat |
| 12 65 | 131 07 | 10 37 | | | | | | | | | | | | | | | | | | | | | | 12 65 | 131 07 | 10 37 | Augua Fria Canyon |
| | | | | | | | | | | | | | | | | | | | | | | | | 4 18 | 76 74 | 18 33 | Aul & Anderson |
| | | | | | | | | | | | | 18 00 | $243 24 | $13 89 | | | | | | | | | | 18 00 | 243 24 | 13 51 | Baker Prospect |
| | | | | | | | | | | | | | | | | | | | | | | | | 47 55 | 708 68 | 14 90 | Barrel Springs |
| | | | | | | | | | | | | | | | | | | | | | | | | 31 00 | 390 56 | 6 46 | Bear Valley Mountain |
| | | | | | | 22 00 | $174 57 | $7 93 | | | | | | | | | | | | | | | | 98 78 | 1,564 71 | 15 85 | Big Oak |
| | | | 40 00 | $233 23 | $5 83 | | | | | | | | | | | | | | | | | | | 56 82 | 529 09 | 11 04 | Black Spring |
| | | | | | | | | | | | | | | | | | | | | | | | | 123 69 | 2,060 39 | 16 43 | Boarding House Vein |
| | | | 22 00 | 395 43 | 17 98 | | | | | | | | | | | | | | | | | | | 22 00 | 395 43 | 17 97 | Buckeye Mine |
| | | | | | | | | | | | | | | | | | | | | | | | | 13 88 | 332 75 | 24 00 | Champion |
| | | | | | | | | | | | | | | | | | | | | | | | | 39 72 | 682 25 | 22 06 | Chenoweth |
| | | | | | | | | | | | | | | | | | | | | | | | | 30 12 | 473 61 | 46 80 | Dunn |
| 32 80 | 644 78 | 19 84 | | | | Concentrate | | 44 91 | | | | | | | | | | | | | | | | 132 27 | 2,518 26 | 19 06 | Elizabeth |
| | | | | | | 20 00 | 4,149 96 | 207 49 | Pocket | $75 14 | | 91 00 | 1,370 45 | 50 66 | | | | Pocket | $165 99 | | | | | 51 00 | 6,401 54 | 125 52 | Evans |
| | | | | | | | | | Pockets | 1,598 57 | | Pockets | 2,450 02 | | Pockets 8 00 | $142 52 587 22 | $59 67 | | | | 160 lbs | $2,054 71 | | 8 50 | 7,333 04 | | Fourmer Shaft |
| 8 00 | 160 87 | 20 09 | | | | 18 00 | 665 90 | 37 15 | 26 50 | 775 83 | $26 30 | 58 50 | 572 04 | 10 70 | | | | | | | | | | 108 00 | 2,477 34 | 19 96 | French Camp |
| | | | | | | Pocket | 597 68 | | Pocket | 216 95 | | | | | | | | | | | | | | 8 51 | 376 63 | 44 21 | French Mine |
| | | | | | | | | | | | | | | | | | | | | | | | | Pocket | 814 54 | | Near French Mine |
| | | | | | | | | | | | | | | | | | | | | | | | | 88 42 | 726 22 | 8 34 | Gardner Vein |
| | | | | | | | | | 12 50 | 329 53 | 26 37 | 9 00 | 117 28 | 16 38 | | | | | | | | | | 85 12 | 1,633 03 | 19 20 | Gilmore Vein |
| | | | | | | | | | | | | | | | | | | | | | | | | 24 58 | 1,727 44 | 70 35 | Gold Bring |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | Gold Hill |
| 2,219 00 | 33,260 66 | 14 98 | 1,559 20 | 15,757 04 | 8 08 | 3,668 00 | 33,376 20 | 9 10 | 1,158 00 | 10,341 61 | 8 93 | 577 00 | 9,160 02 | 15 76 | 19 50 | 259 61 | 13 30 | | | | | | | 261 00 | 1,539 94 | 87 [illegible] | 10,625 71 | 119,149 70 | 10 25 | Green Gulch |
| | | | 22 50 | 313 99 | 13 95 | | | | | | | | | | | | | | | | | | | 22 50 | 313 99 | 13 96 | Green Gulch Extension |
| | | | 18 50 | 133 32 | 5 05 | | | | | | | | | | | | | | | | | | | 24 00 | 305 63 | 12 73 | Grizzly Gulch |
| | | | | | | | | | | | | | | | 15 00 | 340 18 | 23 25 | | | | | | | 37 00 | 704 14 | 19 00 | Guadaloupe |
| Pocket 8 00 | 89 47 535 63 | 55 70 | 18 00 | 204 68 | 30 40 | | | | | | | | | | | | | | | | | | | 37 22 | 1,338 28 | 40 16 | Hacker Mine |
| | | | | | | | | | | | | | | | | | | | | | | | | 16 84 | 301 94 | 17 91 | Hardscrabble |
| | | | | | | | | | | | | | | | | | | | | | | | | 5 52 | 162 01 | 29 38 | Kangaroo |
| | | | | | | | | | | | | | | | | | | | | | | | | 8 60 | 103 86 | 12 30 | Lewis Brothers |
| 68 20 | 732 36 | 10 74 | 1,080 00 | 1,002 43 | 1 48 | 2,447 00 | 15,756 36 | 6 44 | 638 00 | 9,103 64 | 9 28 | | | | | | | | | | | | | 1,180 00 | 1,180 32 | 1 67 | 6,345 93 | 108,826 44 | 11 65 | Long Mary |
| | | | | | | | | | | | | 18 00 | 256 88 | 14 49 | | | | | | | | | | 1,249 14 | 37,691 35 | 22 35 | Louis |
| | | | | | | | | | | | | 16 00 | 231 42 | 14 14 | | | | | | | | | | 13 00 | 141 42 | 14 14 | Louis Extension |
| | | | | | | 60 00 | 349 15 | 5 81 | | | | | | | | | | | | | | | | 146 59 | 9,836 66 | 13 37 | Ludwig Vein |
| 563 00 | 3,045 84 | 5 41 | 2,447 90 | 17,199 52 | 7 01 | | | | 419 00 | 5,352 72 | 12 75 | 313 00 | 1,764 41 | 5 63 | 518 50 | 3,254 53 | 6 32 | | | | 400 00 | 4,354 04 | 11 53 | 11,278 74 | 693,265 25 | 6 17 | Mariposa |
| | | | | | | | | | | | | 64 00 | 653 51 | 10 00 | Pocket 23 00 | 345 47 444 72 | 19 34 | 14 00 | 259 36 | $18 48 | 7 50 | 345 60 | 46 08 | 252 10 | 3,519 60 | 13 30 | Massa Garden |
| Pocket | 62 00 | | | | | | | | | | | | | | | | | | | | | | | Pocket | 62 00 | | Mexican Mine |
| | | | | | | | | | | | | | | | | | | | | | | | | 7 55 | 54 58 | 7 45 | Missouri Gulch |
| 10 00 | 126 77 | 12 68 | | | | | | | | | | | | | | | | | | | | | | 27 47 | 1,135 44 | 24 42 | Mocking Bird |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | Molly Gibson |
| 16 60 | 89 18 | 5 92 | 287 50 | 1,677 60 | 5 90 | 35 00 | 308 34 | 8 81 | 271 00 | 2,522 37 | 9 31 | 80 00 | 759 23 | 9 49 | 46 75 | 362 53 | 7 93 | | | | | | | 1,366 09 | 29,952 75 | 12 27 | Mount Ophir |
| | | | | | | | | | | | | | | | Pocket | 711 65 | | | | | | | | Pocket | 711 65 | | Mount Ophir Rock Wall |
| | | | | | | 23 00 | 985 77 | 42 86 | 30 00 | 3,677 13 | 94 38 | 68 00 | 5,156 68 | 75 83 | 80 50 | 2,450 35 | 30 38 | 13 00 | 227 02 | 17 49 | 34 00 | 372 24 | 11 63 | 327 50 | 15,792 43 | 47 52 | Mountain View |
| | | | | | | | | | | | | | | | | | | | | | | | | 74 81 | 1,689 98 | 22 60 | Oak Springs |
| | | | | | | | | | | | | | | | | | | | | | | | | 59 10 | 735 78 | 12 80 | Odez Vein |
| | | | | | | | | | | | | | | | | | | | | | | | | 7 85 | 164 02 | 20 91 | Ono Mine |
| | | | | | | 528 00 | 3,122 26 | 5 80 | 259 00 | 1,101 21 | 4 25 | 123 00 | 875 54 | 7 12 | 253 75 | 1,785 51 | 7 04 | 151 00 | 666 00 | 4 41 | | | | 1,324 75 | 7,851 52 | 5 71 | Paine's Shaft |
| 17 00 | 278 58 | 16 39 | | | | | | | | | | | | | | | | | | | | | | 17 00 | 278 58 | 16 40 | Pendola Garden |
| 130 00 | 272 50 | 2 10 | | | | | | | | | | 10 00 | 198 01 | 19 45 | | | | | | | | | | 150 00 | 272 53 | 2 10 | Phoebe Shaft |
| 2,998 50 | 34,434 93 | 19 16 | 3,536 90 | 17,284 02 | 13 35 | 4,050 00 | 53,780 61 | 11 28 | 3,155 90 | 36,844 24 | 11 68 | 1,956 00 | 22,600 55 | 11 55 | 2,695 90 | 27,337 46 | 10 14 | 849 50 | 6,876 06 | 10 80 | 1,459 50 | 21,061 06 | 20 00 | 28,967 82 | 374,748 93 | 12 46 | Pine Tree & Josephine |
| | | | | | | 38 00 | 232 36 | 6 12 | | | | | | | | | | | | | | | | 38 00 | 232 36 | 6 12 | Pine Tree & Jos. Extension |
| Pocket | 52 63 | | Pocket | 259 02 | | | | | | | | | | | | | | | | | | | | 37 87 | 2,164 45 | 57 06 | Porphry Hill |
| 16,744 00 | 46,130 43 | 2 88 | 3,028 80 | 6,378 26 | 2 07 | 706 00 | 3,364 43 | 4 26 | | | | | | | | | | | | | | | | 114 00 | 463 97 | 4 05 | 350,329 37 | 1,128,373 56 | 3 36 | Princeton |
| | | | 58 50 | 455 62 | 7 70 | | | | | | | 10 00 | 198 01 | 19 45 | | | | | | | | | | 77 50 | 653 63 | 8 44 | Princeton Vein Outcrop |
| | | | | | | | | | | | | | | | 350 00 | 498 47 | 1 42 | 2,135 00 | 2,811 53 | 1 32 | 3,530 00 | 3,531 48 | 1 18 | 6,015 00 | 7,139 48 | 1 85 | Phillips Dump (Princeton) |
| 473 00 | 3,242 21 | 6 84 | | | | | | | | | | | | | | | | | | | 182 50 | 1,787 01 | 19 15 | 657 50 | 6,029 22 | 9 16 | Queen Specimen |
| | | | 31 00 | 491 87 | 12 97 | 103 00 | 704 72 | 6 82 | Pocket | 352 41 | | Pockets 33 20 | 534 15 612 56 | 24 46 | Pocket 70 50 | 150 30 1,241 72 | 16 26 | | | | | | | 243 70 | 4,101 73 | 17 22 | Reeds Flat |
| | | | | | | | | | | | | | | | | | | | | | | | | 168 00 | 3,117 93 | 12 56 | Reynolds Vein |
| | | | | | | | | | | | | | | | | | | | | | | | | 1,911 20 | 1,580 22 | 83 | River Tunnel |
| | | | | | | | | | | | | | | | | | | | | | | | | 14 30 | 189 60 | 13 17 | Roosevelt |
| | | | | | | | | | | | | | | | | | | | | | | | | 46 74 | 141 21 | 7 30 | Scorpion |
| | | | | | | | | | | | | | | | | | | | | | | | | 12 63 | 317 43 | 26 37 | Simpson Vein |
| 10 00 | 138 96 | 12 90 | 254 00 | 4,287 46 | 16 89 | | | | | | | | | | | | | | | | 10 00 | 137 49 | 12 74 | 501 98 | 11,576 42 | 19 00 | Stockton Creek |
| | | | 10 00 | 97 54 | 9 75 | | | | | | | 10 00 | 199 78 | 19 91 | 15 00 | 153 13 | 10 24 | | | | | | | 41 00 | 420 45 | 10 27 | Stockton Cr. Tunnel |
| | | | | | | | | | | | | | | | | | | | | | | | | 185 54 | 2,689 73 | 14 51 | Texas Mine |
| | | | | | | | | | | | | | | | | | | | | | | | | 23 37 | 249 65 | 10 77 | Thomas & Beamon |
| | | | | | | | | | 10 00 | 49 28 | 4 93 | | | | | | | | | | 182 00 | 680 93 | 3 69 | 309 56 | 2,904 51 | 9 40 | Turner Mine |
| | | | | | | 103 00 | 856 01 | 8 32 | | | | | | | | | | | | | | | | 142 68 | 1,335 25 | 8 92 | Watson Vein |
| 12 00 | 44 93 | 3 76 | | | | | | | | | | | | | | | | | | | | | | 59 60 | 457 80 | 8 22 | Wet Branch |
| 12 20 | 132 66 | 10 89 | | | | | | | | | | | | | | | | | | | | | | 12 20 | 132 66 | 10 89 | Wildcat |
| | | | | | | | | | | | | | | | | | | | | | | | | | 1,304 94 | | Mucci Scraps |
| 23,352 15 | $145,962 66 | $6 25 | 12,431 50 | $94,731 90 | $7 62 | 11,921 00 | $116,489 39 | $9 77 | 6,092 00 | $70,153 14 | $11 70 | 3,396 70 | $48,092 07 | $14 17 | 4,098 90 | $42,010 59 | $10 25 | 2,007 50 | $11,141 51 | $5 55 | 6,959 50 | $49,838 66 | $5 85 | 521,915 91 | $2,735,852 99 | $5 10 | Totals |

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In the River Tunnel 1200 ft. below the level of the New Pine Tree Tunnel, it is stated by the operators that the Josephine vein appears but that the Pine Tree vein is not to be seen. Storms in 1900 mentioned that the Pine Tree and Josephine veins were close together in the Josephine Mine on the level of the English Trail drift "about 400 ft. north of the point of meeting on the croppings" and "are separated by a mere seam no thicker than a knife blade." He also mentioned the divergence of the veins going northward from there. The occurrence of erythrite (cobalt bloom) was reported by H. W. Turner, and danaite (a cobalt-bearing arsenopyrite) was reported by the State Mining Bureau 40 years ago in talc schist between the Josephine and Pine Tree veins.

Although the work is in the nature of prospecting and development in large part, preparatory to operation on a bigger scale by other methods, it may be noted that a total crew of 36 men were mining and milling 101 tons of ore daily in June, 1934, or nearly 3 tons per man-shift, with part of the crew engaged in sinking. Favorable and creditable costs for mining, development and milling were being achieved, and an operating profit was being made on ore yielding from 0.2 to 0.3 ounce of gold per ton.

*Princeton Mine* at Mt. Bullion has probably been the largest gold producer in the county. It is said to have been opened in 1852, and was credited for a time with being the heaviest producer in the State, yielding $90,000 a month. The ore yielded up to $70 a ton within 100 ft. of the surface. By 1867 it had been opened to an inclined depth of 560 ft. (200 ft. vertical) and had been opened on the strike for 1200 ft. J. Ross Browne in that year recorded the following figures of production:

| | *Tons* | *Value* |
|---|---|---|
| January, 1859, to June 1, 1860 | 2,000 | $36,000 |
| June 1, 1860, to Nov. 1, 1860 | 23,916 | 527,633 |
| In 1862 and 1863 | 121,000 | 2,000,000 |
| In 1864 | | 243,707 |

The total production up to 1867 was reported over $3,000,000. After 1864, when the Princeton was regarded as bottomed, and the Frémont Grant was in financial difficulties, a creditor took out the pillars and other ore in sight, dumped waste in the shaft, and left the mine in such bad shape no one wished to reopen it.

When the mines on the Frémont Grant came under the control of a British firm about 1899, the Princeton was reopened by a new inclined shaft. It was found the old company had indeed struck a lean zone at 600 ft. and the best ore left assayed only $2 a ton. The new operators, under the management of John H. Mackenzie, sank deeper and found "long and wide bodies of good ore—$5 and $4.50 a ton, between 600 and 1000 ft. levels," according to Mackenzie. Soon after, the Princeton resumed its position as the best producer in the county, yielding $1,228,273.56 from 350,329 tons of ore between 1900 and 1915, nearly all prior to 1911. Since then, little has been done. The shaft had reached a length of 1660 ft. with 8 levels, 11,418 ft. of drifts and 3127 ft. of crosscuts and raises. The vein was reported to average 8 ft. wide, in Mariposa slate and dipped 45° to 60° NE. Ore was stoped out as far down as the 1200-ft. level.

*Tyro Mine,* south of the Malvina, on the west side of the Mother Lode, was productive principally in the period 1893 to 1897, although it had been worked previously. The production is estimated to have been over $110,000 during a period of four years when a 10-stamp mill was operated.

The vein has Mariposa slate walls and is reported 2 to 7 ft. wide in different parts of the workings, with gouge on both walls. It carried finely divided gold and the sulphide content was reported to be 3%, consisting of iron and copper sulphides, including some covellite.

The last shaft was sunk 700 ft. by 1896, and had six levels with only 1870 ft. of drifts reported. An orebody is said to have been stoped for a length of 80 ft. down to the 700-ft. level. There is an old shaft connected by air passages with the later work. There is no record of work after 1897.

*Virginia Mine,* 4 miles south of Coulterville, was one of the first claims patented in the county. It has been a frequent but not regular producer and has been worked on a small scale, with a creditable total output from a small tonnage of ore. There are five patented and one unpatented claims.

The vein generally ranges from 8 inches to 4 ft. wide, though at times larger. The hanging wall is greenstone at the south and Calaveras formation on the north and footwall serpentine. The ore varies a great deal in gold content, from low-grade milling ore to 'specimen quartz,' as is common with veins associated with serpentine. The mine has been worked in a hand-to-mouth manner, passing from one stock company or operator to another. The plant is small and buildings, though numerous, are old. The total production from 1898 to 1931, inclusive, has been over $660,000 from ore that has averaged over $10 a ton. In 1932 it was claimed that mining and milling cost $9 a ton.

At that time a raise was being put up from the 1300-ft. to 1200-ft. level and a drift was being run in ore on the former level. The shaft is an incline on the vein. The work in 1932 was in search of the north shoot, which had been of good width and grade on the 1200-ft. level, but quite short. The south shoot extended down to the 700-ft. level, where it was said to shorten to 20 ft. in length, and had not been found below there, so that ore so far as known was mined out to the 1200-ft. level.

The larger and more productive part of the work was done by the Procter & Gamble interests between 1915 and 1922 and from the 400-ft. level to 1050 ft. deep. They made some profit.

The mine plant includes an Imperial Type-10 air compressor with 50-h.p. motor, drill sharpener, hoist and 52-h.p. motor. The milling plant contains a rock-breaker, ten 1050-lb. stamps, with 50-h.p. motor; 3½-ft. Hardinge mill, two old vanners and several small electric motors. There are 13 old wooden buildings on the claims.

## METALLURGY

From the beginning of quartz mining in California until only a few years ago progress in ore treatment has been directed largely along one line, the improvement of the gravity stamp mill and the increase in its capacity. The stamp, after the arrastre, was the first ore-crushing machine brought to the attention of the miners. There are many reasons why it should have intrenched itself in favor, and maintained its place. The first of these was its simplicity and general dependability. Stamp stems, shoes, dies, cams and tappets are simple to make and install. The earliest mills had square wooden stems, and square shoes and dies, wooden mortar blocks and mortars too large in capacity. The first improvement was to provide rotation (said to have been made by George Stanford), in order to give even wear on shoes and dies. The circular stem, the cam, and the tappet were thus evolved. The next problem was to increase capacity. This could be done in many ways—heavier stamps and larger stamping surface, more drops per minute, higher drop, lower discharge and coarser screening, and with less space in the mortar. Of all these factors, the tendency has been to increase stamp weight most noticeably, and increase the running speed, *i. e.*, number of drops, somewhat, and reduce space inside the mortar. Other variants have remained quite constant. Weight of the stamp assembly has thus been increased along the Mother Lode from 250 lb. to 1250 lb. The only other radical change over a long period of years was the adaptation of stamps as intermediate crushers, followed by Hardinge mills.

Some of the other advantages of the stamp battery as a unit in ore treatment are: (1) Moderate power needed, and no excessive power required for starting. (2) Quick and simple cleaning up of one battery at a time, without necessity of stopping the entire mill. (3) Range in size of ore fed and in reduction. (4) Quick and simple replacement of worn parts, with wear mostly on cheap parts. (5) Low operating costs.

An interesting example of the advances made in the evolution of the stamp-mill was the addition of 20 stamps to the Lightner mill of 40 stamps at Angels Camp. This addition, although it was built in 1907, shows what good Mother Lode practice was at a time when large tonnages of low-grade ores were being handled. Its specifications were:

Stamp weight complete, 1000 lb. Drop 7 inches, 106 times a minute; height of discharge above die (new) 7½ inches. Shoes were of chrome steel and Pennington hammered steel, weighing 181 lb. new and 25 to 30 lb. when worn out; they lasted 10 months. Dies were of semi-steel, 5½ inches high, weight 82 lb. new and 30 lb. when worn out; they lasted 8 months. Thirty-mesh punched screen was used, and each battery had 308 sq. in. of clear screen. The mortars were of 'close pattern,' with no surplus room either between the stamps themselves or between stamp and mortar lining. The stamp stems were held

rigidly in line by Pacific Battery Stem Guides. The mortar blocks were of sugar pine on concrete foundations. Each battery had 88 sq. ft. of outside copper plates (2 plates each 2 ft. by 22 ft.) with 2½ oz. of silver plating per sq. ft. The grade was 2 in. per ft.

There were three 4-ft. Frue vanners for each 5-stamp battery. The water required for each battery was 8 gallons per minute, and for each concentrator, 1 gallon per minute additional.

The capacity of these stamps (over 5 tons each in 24 hours) was 10% to 15% more than in the old mill, with no more power required and no greater tailing loss. The recovery of gold inside the mortar was 25% as compared with 20% in the old mill. The shoes and dies also had longer life. The recovery was 92% or better with a tailing loss of 20 cents to 25 cents a ton on ore ranging in recovered value from $3 to $4 a ton in 1907 and 1908.

The 20 stamps, 12 Frue vanners, 36 ft. of 4-inch mill line-shaft and 34 ft. of 2-inch counter-shaft for concentrators required 40 h.p. The labor cost for milling had averaged 22½ cents a ton with the old 40 stamps; with the 20 new stamps added, the cost of this item was reduced to from 15 to 20 cents a ton.

This mill addition was designed by D. C. Demarest and all of the iron work was done by the Angels Iron Works, Angels Camp. Here was another reason why the stamp mill was so popular; there were (and still are) several such foundries along the Mother Lode that have done good work in the designing and making of large stamp mills, and supplying parts which required periodical replacement, obviating the necessity of going elsewhere, and the delays due to shipping from a distance, particularly during the many years before the advent of the automobile, when roads were impassible during the entire rainy season and until late in the spring.

Companion to the stamp mill in most of the plants was the endless belt vanner, generally the Frue, although modifications of it, and others such as the Johnston and Tulloch were also used. The principle on which these work is the separation of the heavy minerals (sulphides and gold) from the lighter (quartz, slate or other gangue) in a lower layer by mechanical agitation on a shaking and upward-moving surface, generally a smooth belt of 2-ply rubber with upturned sides. The dragging action of the upward-moving belt to which the heavy sulphides cling, permits them to be carried over the upper end of the vanner and down into a box filled with water, into which they drop. Meanwhile the lighter, upper layer of gangue is being washed downward and off the lower end of the belt into a tailings launder by fine streams of water. The belt travel on these vanners ranges from 2 to 5 ft. a minute. The side shake, with a throw of about an inch, is made at the rate of from 180 to 216 times a minute. The power required for a vanner is therefore small, from one-fourth to less than one horsepower. The capacity depends on speed and grade (slope of belt) of the vanner and pulp size, varying from 4 to 7 or 8 tons each 24 hours. Excessive belt speed may lower saving.

Originally intended for handling fine sands and slimes, the vanners in Mother Lode mills have usually been run directly on the pulp from the amalgamating plates, without classification, and so have really given excellent results, considering the wide range of screen sizes of feed. A check of the pulp passing onto the plates and thence directly

to Frue vanners at the Argonaut mill in 1913 showed the following, using a 16-mesh battery screen:

| *Screen size* | *Per cent* |
|---|---|
| On 40-mesh | 13.33 |
| On 60-mesh | 16.67 |
| On 80-mesh | 11.67 |
| On 100-mesh | 9.33 |
| On 150-mesh | 6.67 |
| On 200-mesh | 5.84 |
| On 300-mesh | 1.50 |
| Through 300-mesh | 31.67 |

At that time, the tailing from the vanners was run over a buddle 30 ft. in diameter and with 16 decks. The 16 vanners were saving 3½ tons of concentrate daily and the buddle less than one-half ton daily. Sixty per cent of the gold was saved by inside amalgamation, 10% on the plates and 15% in the concentrate.

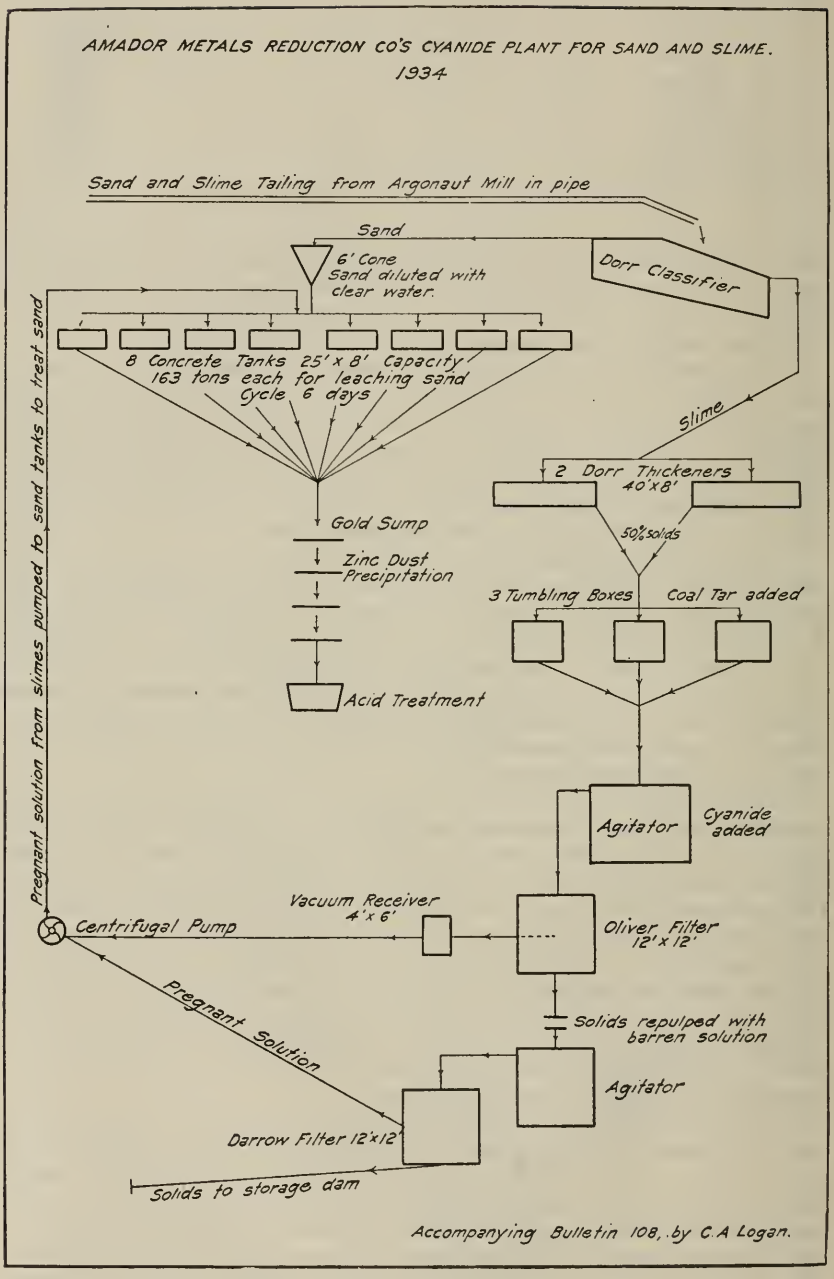
Classification had not given any notable or consistent increase in saving where it had been tried; up to the time of the war the only companies that tried it seriously were the Original Amador and the Plymouth. The flow sheet at the former property in 1915 is shown, *post,* as one of the steps in Mother Lode metallurgy. The ore at that mine, however, is 'gray ore,' entirely different from the slate-quartz ores of the mines working in the Mariposa slates.

The treatment of concentrate by chlorination began at an early date, and the process survived at the Kennedy Mine until 1915. This mine also had a large canvas plant for the treatment of tailing after it passed the vanners and this was the last of its kind in commission on the Mother Lode. The advent of the cyanide process about 1896 at once drew attention to the tailings from the quartz mines and many efforts to so treat these tailings (especially those from the slate ores) were unsuccessful. Concentrate for the most part was shipped to Selby smelter on San Francisco bay.

For many years re-precipitation or adsorption of gold by the carbon in the Mariposa slate was believed to be the reason for the failure of the cyanide process to give satisfactory results on these tailings and concentrates. The tendency of the slate to form slime in the stamp mill also was a bad feature. In 1922 it had been noted at the Belmont Shawmut Mine in Tuolumne County in the course of experimentation in ore dressing, that the oil-floated concentrate made at that time (as distinguished from the present-day flotation concentrate, produced with the use of many chemicals) responded better to cyanide treatment than the table concentrate. Accordingly, 8 to 10 lb. of California crude oil was added per ton of concentrate when regrinding preliminary to cyanidation.

Somewhat later, at the plant of Amador Metals Reduction Company, a custom cyanide plant treating the entire mill tailings from the Argonaut mill (see flow sheet, *post*) the use of certain soluble coal tars for temporarily inhibiting the precipitating action of the carbon in the slimes was introduced. About 4 lb. of such coal tar per ton of slimes is used. An emulsion is formed by agitating the slimes and coal tar in three tumbling boxes. The effect is only temporary, and the slimes must be sent within a few minutes to the Devereaux

Flow Sheet No. 12.



agitator for cyanidation, and after 20 minutes treatment there, to the filter.

In 1930, Leaver and Woolf in Technical Paper 481 of the U. S. Bureau of Mines, made public the results of some tests on slime tailings from several of these mines. Instead of treatment with coal tar previous to cyanidation, 3 to 5 lb. of paper-mill waste sulphite liquor per ton of tailings was used. The tabulation of results shown below is summarized from their report.

Percentage of gold extracted in cyanidation tests on slimes from

| | Kennedy | Argonaut | Central Eureka | Plymouth |
|---|---|---|---|---|
| Untreated slime | 67.8* | 60.7 | 14.8 | 27.7 |
| Treated slime | 75.0 | 71.5 | 61.0 | 53.2 |

* Sample contained 15% fine sand.

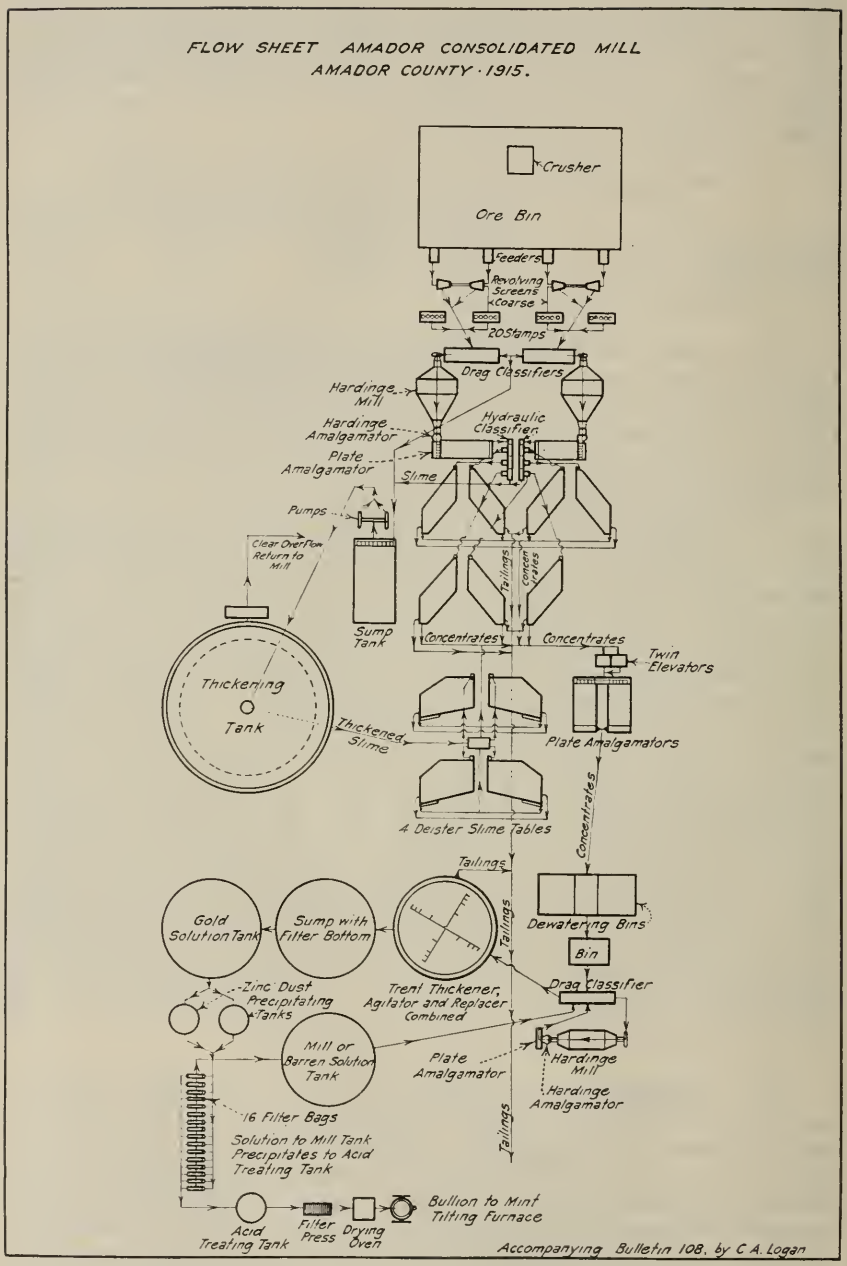
These tests also indicated that the cyanide solution acted very rapidly in dissolving the gold in the Argonaut slimes, only 5 minutes agitation of untreated slimes giving higher extraction than 2 hours agitation. It can not be definitely stated whether the remaining gold (34.7%) was entirely lost by adsorption or re-precipitation by the carbon, or was held in some form insoluble in cyanide.

The practice of using stamp mills and vanners on the Mother Lode to the exclusion of nearly all other equipment has often been criticized. But after all, the working of a mine is a business adventure, the sole aim of which is to make the largest net profit possible with a given investment. In the case of ores of as low average gold content as those which have produced most of the tonnage from the Mother Lode, an increased saving of 5% or 10% of gold content by another method than stamp-milling might not be enough to pay for the capital outlay for new plant and increased cost of treatment. There have even been cases where putting a finer screen on a stamp battery was not justified because of the reduction in capacity, although such a change might decrease tailing loss decidedly. With $3 ore, tailing containing 30 cents a ton would not be unsatisfactory. If ore grades increase, or if costs rise as they did in 1915–1916, when low-grade mines had to close and only the better ore could be worked, tailing loss becomes more important. With the background of 65 years of stamp milling so briefly alluded to, the writer will trace the development of Mother Lode metallurgy from 1914 to 1934. This can best be done by the discussion and illustration of flow-sheets. Of those mentioned, 13 are illustrated.

## Plymouth Mill

The Plymouth mill, in 1914, was the first decided break with precedent on the Mother Lode. It was the first property where ore was delivered to the mill from the shaft by a belt conveyor, and another conveyor distributed the ore over the mill-bins which were flat-bottomed and had a capacity of 1400 tons. Thirty 1250-lb. stamps dropping 7 inches 104 times a minute crushed the ore to 4-mesh (0.19 in.) and had a capacity of 14 tons a day each. This was another decided innovation. Classification began with the stamp pulp; cones separated the fines and sent them over ten 6 ft. by 12 ft. plates for amalgamation while coarse feed went to two 8 ft. by 22-inch Hardinge

Flow Sheet No. 1.



mills and after crushing, to the plates. The plate tailing was elevated and again classified. The overflow of a sloughing-off cone went to 24 Isbell vanners, and its underflow was again split into coarse and fine parts by a Richards hindered-settling classifier. The coarse sand was sent to two No. 6 Wilfley tables which handled 35 tons each and the fine sand was handled on six Isbell vanners.

Some of the results obtained with this mill were listed by Caetani after it had been in operation two months. If amalgam were kept soft by plentiful addition of mercury, amalgamation was complete in the Hardinge mills but on cleaning up the amalgam was found in the bottom of mill in a "slough of amalgam, iron and sand." When insufficient mercury was fed, the amalgam hardened, crumbled and came out of the mill. There was a large mercury loss in the Hardinge mill.

The 2-stage crushing reduced the wide range of screen sizes of product and was believed to give a lesser percentage of colloidal material and to increase recovery. The mill crushed 95% through 60-mesh and it was estimated the Hardinge mills were doing work equivalent to that of 50 stamps at a cost of 11.4 cents a ton.

The largest percentage of total gold loss was in the colloids. Caetani believed this was probably due to floating of arsenopyrite. (It is interesting to note here that in analyses of slimes from the Mother Lode mills reported in U. S. Bureau of Mines Technical Paper 481 that from the Plymouth contained 18.04% $Al_2O_3$, 5.15% $K_2O$ and 0.20% arsenic, but less sulphur than the Kennedy, Argonaut or Central Eureka slime).

The percentage of recovery indicated by 45 assays of mill-heads and 49 of total tailings was between 88% and 89%.

### Original Amador Mill (see Flow Sheet No. 1)

This mill was remodelled, with the addition of much machinery in 1915. Previously it had contained twenty 1000-lb. stamps dropping 105 times a minute and crushing 90 tons daily through 20-mesh wire screen, with inside and outside amalgamation, and concentration of sulphides on 7 Deister concentrators and 1 Frue vanner. After the change, the mill handled 300 tons daily and a recovery of 90% was claimed. The ore was the 'gray ore' of the lode consisting of hydrothermally altered greenstone containing 3% to 5% of sulphide. Most of the gold was in the sulphide and the ore averaged $3.50 to $4 a ton in gold.

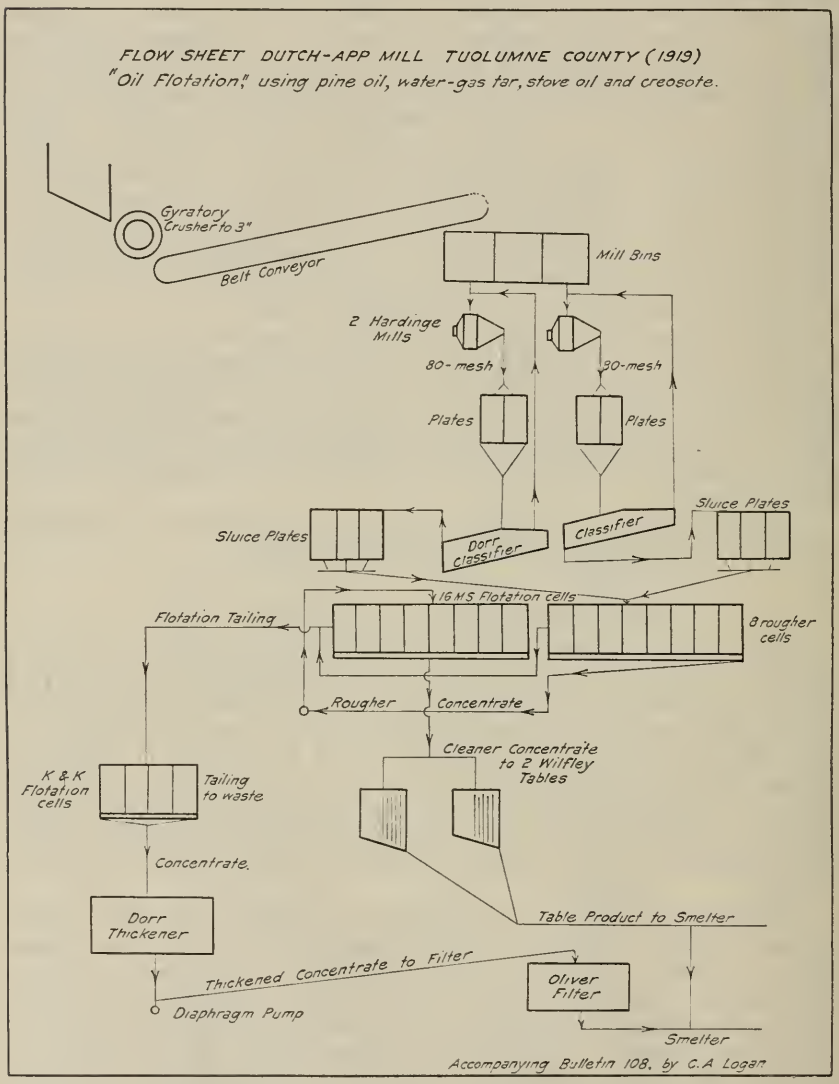
Inspection of the flow sheet shows the emphasis laid upon classification or sizing. This began with screening even ahead of the stamps. Slime was separated following stamping, and concentrated on Deister slime tables. Another novelty was the Trent Thickener, Agitator and Replacer combined. Concentrate was ground to −200 mesh in a 4½ ft. by 72-inch Hardinge mill in closed circuit with a drag classifier and grinding in cyanide solution. A Hardinge amalgamator and small plate below this mill saved 5% of gold freed in grinding before cyanidation.[1] O'Brien described the process of cyanidation as follows:

> "The overflow from the classifier is pumped to one 18-ft. diameter by 12-ft. deep treatment tank equipped with the Trent cyaniding apparatus. This tank, with a dillution of 70%, has a capacity of 30 tons of concentrates. When starting to grind a charge, the treatment tank is filled with barren

[1] O'Brien, T. S. Eng. & Mg. Jour. Vol. 100, No. 7, p. 256.

solution and the circulating pump started while the valves are set to operate as a thickener and replacer. Then the pulp from the classifier, having about 80% dilution and having had about 50% of the values dissolved during grinding, is pumped into a 12 x 12-in. box hung in the center and submerged 3 feet. While the charge is being ground and thickened in the bottom of the treatment tank, the clear overflow, with a large percentage of the dissolved values, goes to the sump tank, which has a filter bottom. After the charge is ground and previous to agitation, about 50% of the solution

Flow Sheet No. 2.




in the treatment tank is replaced with barren solution and the valves on the treatment tank changed to operate as an agitator. This process is continued for 6 or 8 hr. after which all the recoverable values are in solution. The valves are again changed on the treatment tank so as to operate it as a thickener and replacer and about 10% in excess of the solution in the treatment tank is replaced with barren solution. Then 20 tons of wash water carrying about 2 lb. alkalinity per ton, is added and the charge allowed to settle into the wash water. The solution above the pulp is then decanted off into the sump tank, and the pulp sluiced to waste."

This plant was closed in 1917 because of trouble with nearby land owners over tailing disposal.

### Dutch-App Mill, 1919 (see Flow Sheet No. 2)

Flotation was introduced on the Mother Lode at about the same time on this property and on the Belmont-Shawmut. Although the ores are quite similar, that of the Dutch and App Mines was coming from shallower depths (between the 1500- and 2300-ft. levels) and contained more free gold. It contained dolomite (or ankerite) mariposite, stringers and bunches of quartz, altered amphibolite schist and Calaveras (Carboniferous) slate. Ore of a maximum size of three inches was fed to the Hardinge mills which ground to –80 mesh. There was ample plate surface for amalgamating both coarse and fine gold. For flotation, pine oil, water-gas tar, stove oil and beechwood creosote were used. The concentrate recovered (nearly all pyrite) made up 8% to 10% of the ore and was worth $40 a ton. A recovery of 90% to 92% was claimed on ore said to average $5 a ton, and probably selected.

This plant never reached its rated capacity of 500 tons a day during the short time it was in operation, so that no representative cost figures were achieved. While crushing 150 tons a day the milling cost was higher than such ore could stand, though the method was technically satisfactory so far as could be learned.

### Treasure Mill, Amador County, 1920 (see Flow Sheet No. 3)

This mill represents a transition stage, in which stamps were dispensed with but the operators were not inclined to go so far as to use the flotation process. Accordingly they resorted to repeated classification, beginning with the screening out of fines from mine-run ore even before primary crushing, and to 2-stage crushing, as well as to ample provision of amalgamating plates and the use of proper tables for the concentration of three different sizes of product. The work of the Frue vanners, which had in most previous mills been loaded with an unclassified feed direct from the stamps, was here confined to the treatment of slimes and very fine sand overflowing from the last classifiers. A separate bin for fine ore permitted running the small Hardinge mills when the large one was idle for repairs.

When operating two shifts this mill handled 90 tons, although rated at 150 tons per 24 hours. The principal motors were one of 35 h.p. on the large Hardinge mill and 75 h.p. on main drive. The ore was the 'gray ore' of the lode, carrying 3% of pyrite concentrate worth usually over $100 in gold (5 oz.) and $1 in silver per ton.

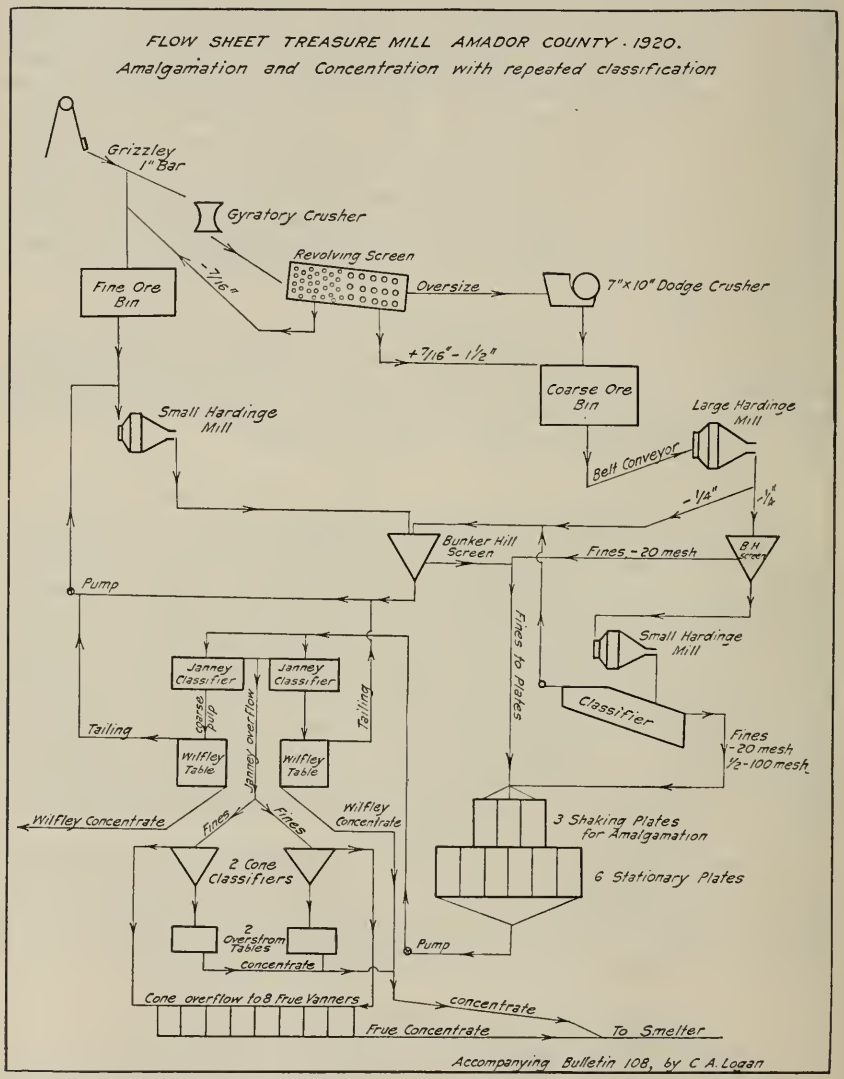
### Belmont-Shawmut Mill, 1922 (see Flow Sheet No. 4)

During the long history of this mine various methods of ore treatment were used. Originally, in working the ores of the shallow zone where considerable free gold occurred due to secondary enrichment, stamp mills were operated and $18 a ton was recovered by amalgamation. Later the sulphide zone yielded much lower-grade ore but still considerable free gold occurred. A 100-stamp mill with 1000-lb. stamps and 40 Frue vanners was used and the concentrate

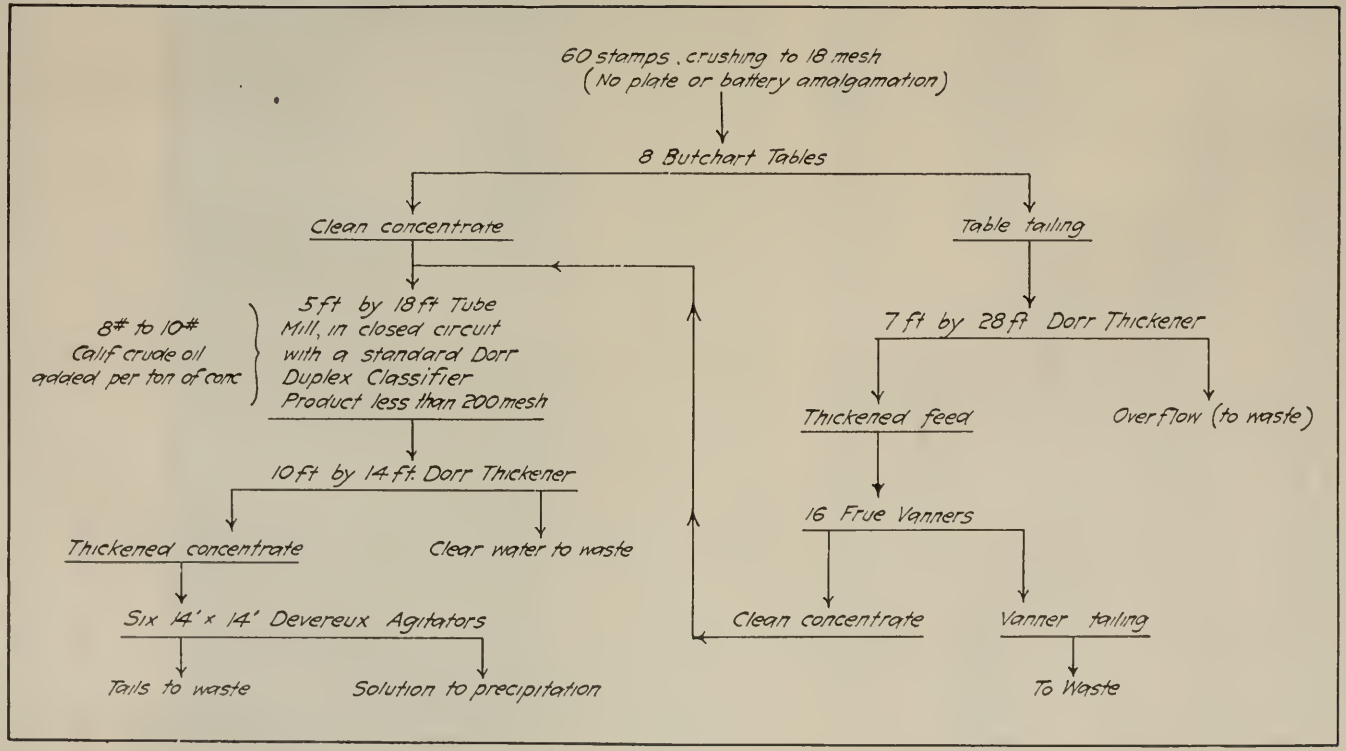
was treated by chlorination. This mill was used until Belmont Mining Company took the property.

Under this company, four types of ore were worked, which were designated for convenience at the mines as banded quartz, impregnated schist and dark and light sulphide ores. Pyrite is the chief sulphide.

**Flow Sheet No. 3.**

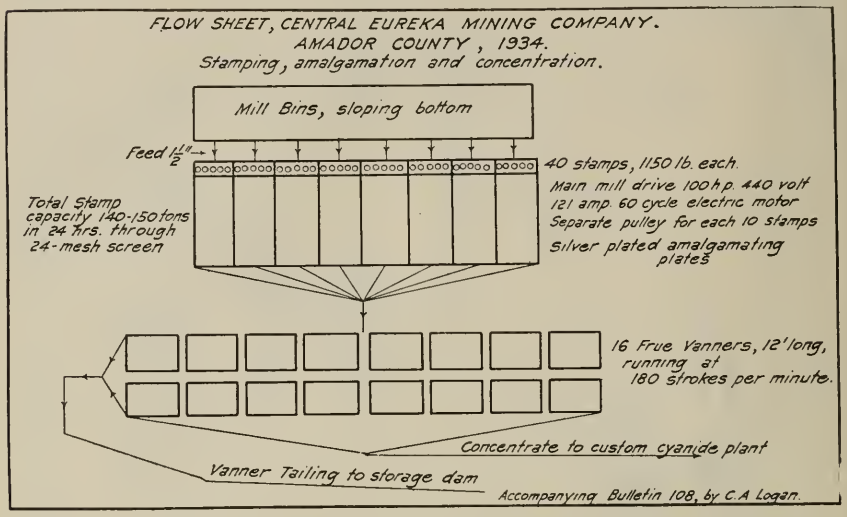



During the later operations concentrate saved was 7% to 10% of the tonnage milled. At first the company installed Jones-Belmont flotation cells to supplement the work of the stamp-mill, and made two grades of concentrate, one on the vanners and the other by flotation. The low grade of the concentrates and the high cost of shipment


60 stamps, crushing to 18 mesh
(No plate or battery amalgamation)
8 Butchart Tables
Clean concentrate
Table tailing
8# to 10# Calif crude oil added per ton of ore
5 ft by 18 ft Tube Mill, in closed circuit with a standard Dorr Duplex Classifier
Product less than 200 mesh
7 ft by 28 ft Dorr Thickener
Thickened feed
Overflow (to waste)
10 ft by 14 ft. Dorr Thickener
16 Frue Vanners
Thickened concentrate
Clear water to waste
Six 14' x 14' Devereux Agitators
Clean concentrate
Vanner tailing
Tails to waste
Solution to precipitation
To Waste

and smelter treatment left such a small margin of profit that experiments in cyanidation were begun. In the course of these experiments, it was found that the oil-floated concentrate responded better to cyanide treatment than did the straight table concentrate.[1] Analyzing the opera-

Flow Sheet No. 5.


FLOW SHEET, CENTRAL EUREKA MINING COMPANY.
AMADOR COUNTY, 1934.
Stamping, amalgamation and concentration.
Mill Bins, sloping bottom
Feed 1½"
40 stamps, 1150 lb. each.
Main mill drive 100 h.p. 440 volt
121 amp. 60 cycle electric motor
Separate pulley for each 10 stamps
Silver plated amalgamating plates
Total Stamp capacity 140-150 tons in 24 hrs. through 24-mesh screen
16 Frue Vanners, 12' long, running at 180 strokes per minute.
Concentrate to custom cyanide plant
Vanner Tailing to storage dam
Accompanying Bulletin 108, by C.A Logan.

tions, it was concluded that the oil used in flotation was responsible for this. There was enough carbon in the ore to cause the same premature precipitation of gold experienced in trying to cyanide slimes from some of the Amador County mines. The flotation oil was apparently giving the same action in temporarily coating and de-activating the carbon, as was later achieved by Amador Metals Reduction Company, who use water-soluble coal tars. However, if the investigators at the Shawmut Mine realized what they had discovered, no announcement was made.

While it was found that flotation was technically successful on this ore, it was more expensive than results justified. The flotation cells were therefore removed and the flow sheet outlined was put into use. There was so little free gold in the deeper ores (between 2600 and 2900 ft. on the dip) that there was no provision for amalgamation. The advantage from the use of oil was preserved by adding 8 lb. to 10 lb. of California crude oil per ton of concentrate to the tube mill circuit while grinding for cyanidation. This flow sheet was used until work stopped in January, 1924. A recovery of 90% to 92% was claimed and a total milling cost of $1.22 a ton was reported late in 1922.

Central Eureka Mill, Amador County, 1934 (see Flow Sheet No. 5)

This is the only mill of any size on the Mother Lode which retains simple stamp milling, amalgamation and concentration of unclassified pulp on vanners. It is an old mill, built by Knight & Company of

[1] Logan, C. A. R. XVIII of State Mineralogist, pp. 748–751, 1922.

Sutter Creek and though the 40 stamps have not been in continuous operation, they have crushed over a million tons of ore since 1911.

The main drive motor is of 100 h.p. (440 volts, 121 amperes and 60 cycles), and there is a separate pulley for each 10 stamps. Stamps fully shod weigh 1280 lb. and drop 96 times a minute. The load per vanner averages about 9 tons a day. Most of the ore handled has been the slate and quartz ore found as lenses and stringers in the Mariposa slate. An analysis of the slimes from this mill made by Peirce R. Perry of the U. S. Bureau of Mines showed 55.02% $SiO_2$, 19.43% $Al_2O_3$, 3.72% Fe, 2.74% CaO, 2.31% MgO, 4.98% $K_2O$ and 2.24% carbon, indicating a higher content of alumina and carbon than in the similar carbonaceous ores of the principal near-by mines. These last two constituents made a particularly difficult slime to treat by cyanidation, so that in preliminary tests by the U. S. Bureau of Mines (see, *ante*) an extraction of only 14.8% of the gold was obtained by cyanidation of untreated slimes. After pretreatment with 5 lb. of paper-mill waste sulphite liquor per ton of tailing, an extraction of 61% was made. During the entire period of operation of the Central Eureka claim this tailing was run to waste or stored in a tailing dam without treatment. Within the last year a cyanide plant has been built to treat it and it is reported that a recovery of over 70% is being made on the

Tailing disposal from mill of Central Eureka Mine, Sutter Creek, Amador County.

*Photo by Walter W. Bradley*

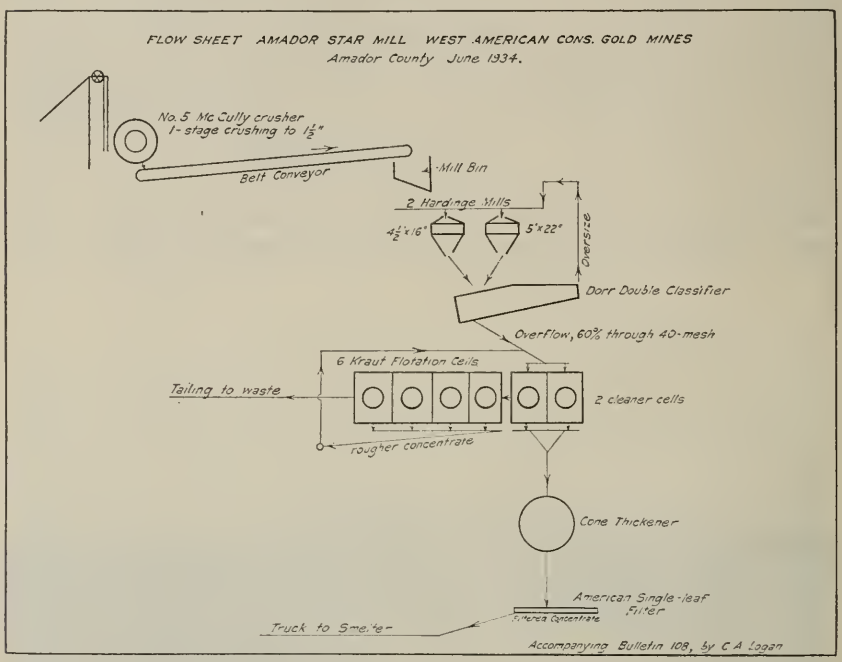
slime and still better on the sand, though this has not been substantiated by personal inquiry.

For the period 1920–1930 the company claimed to be making a recovery of from 89% to 94.31% of mill-heads. The latter figure was

claimed when mill-heads averaged $13.148 a ton for a year, and was probably due to the larger proportion of coarse free gold as compared to gold in sulphides. This ratio has varied from 6:1 to 3:1. Tailing assays were reported from 64 cents to $1.12 a ton. The management believed much of the tailing loss was due to very minute particles of sulphide in the gouge, and to flakes of gold telluride said to occur occasionally in high-grade spots.

In the Old Eureka Mine, from which mill tonnage has been coming during the past few years, the ore is now 'gray ore,' about 90%

Flow Sheet No. 13.




quartz, between greenstone walls on some levels. The percentage of concentrate for the year ended April 1, 1934, was 1.45% and it yielded $86 a ton. A recovery of 93½% of gold was claimed, with tailing assaying 60 cents. The ore came from the 2100-ft. and 2300-ft. levels.

This mill is probably working at a lower cost per ton than any other along the lode except the one at Carson Hill Mines. The total milling cost (including treatment of concentrate but not overhead, taxes and depreciation) was less than 90 cents a ton last year.

## Kennedy Mill

In Mining and Metallurgy, April, 1932, Max Kraut had the following to say regarding the experiments that led to the adoption of flotation at the Kennedy Mine:

"In June, 1931, experiments were made on the ores from the Kennedy mine at Jackson, Calif. Preliminary results indicated a substantial saving in recovery and operating expense by replacing the extensive vanner plant by flotation. At the Kennedy mill the ore was ground through 24-mesh in a battery of 60 stamps

handling about 270 tons of ore per day. The pulp was passed over plates, with the plate tailing treated on a series of 24 vanners. Vanner tailing losses varied considerably, depending on the character of the ore, from $1 to as high as $3 per ton.

"Laboratory experiments were promising, so it was decided to install a 2-cell flotation machine to test the ore in continuous operation, using the plate tailing from one 5-stamp battery. This test work covered five months. Two distinct characters of ore became apparent. From one section of the mine the gold was well liberated at 24-mesh, at which a flotation tailing as low as 30 to 40c per ton was obtainable. From other sections the tailing when grinding to 24-mesh was not less than $1 per ton. Screen analysis of tailing, however, showed that grinding all through 60-mesh would give a 20c tailing and grinding to all through 80-mesh would permit a flotation tailing of less than 5c per ton on both types of ore. So a flotation plant to take care of the entire tonnage of mill plate tailings was built and went into operation a few months ago. Equipment included a 5 by 5-ft. Allis-Chalmers ball mill in closed circuit with an 8 by 24-ft. Dorr classifier. A Dorr thickener was installed to eliminate excess water from the plate tailing. A 10-cell flotation machine, followed by a 2-cell cleaner, comprises the flotation equipment, with a Dorr filter for dewatering concentrate.

"Results have fully justified the new Kennedy installation. Lately, tailing assayed about 20c per ton and often is as low as 5c. Further reduction in tailing losses is expected as present higher tailing is due to inefficient grinding and classification which throws oversize into the flotation feed. After these defects are remedied tailing may be reduced even below 5c.

"Cyaniding at the Kennedy is difficult because the ore contains a large quantity of carbonaceous or graphitic material. This does not interfere with flotation recovery, but does tend to lower the grade of the concentrate. In the cleaning operation a good part of the graphitic material is eliminated, which brings the grade of concentrate up to about $150 per ton. The grade of the vanner concentrate averaged considerably less than that.

"Addition to the cleaner cells of 0.1 lb. of soluble starch per original ton of ore raised the grade of concentrate to over $250 per ton, but these experiments lasted only a few days on account of lack of equipment to handle the starch solution conveniently. The necessary equipment for preparing and feeding the starch will probably be installed shortly whereupon a uniformly higher grade of concentrate should result.

"Reagent consumption at the Kennedy mill is about as follows: American Cyanamid Co., No. 208, 0.03 lb. per ton; ethyl xanthate, 0.001; copper sulfate, 0.01; and pine oil, 0.15.

"Although the minerals to be floated are much the same as in the Grass Valley district, the same reagents can not be used. Xanthate is the only collector required at the Murchie or North Star mine, but at the Kennedy mine this reagent does not permit a good recovery and it was necessary to use Aerofloat No. 208 to obtain satisfactory results. A small amount of xanthate is being used as a precaution although all tests indicate that it has only a slight effect in reducing tailing loss."

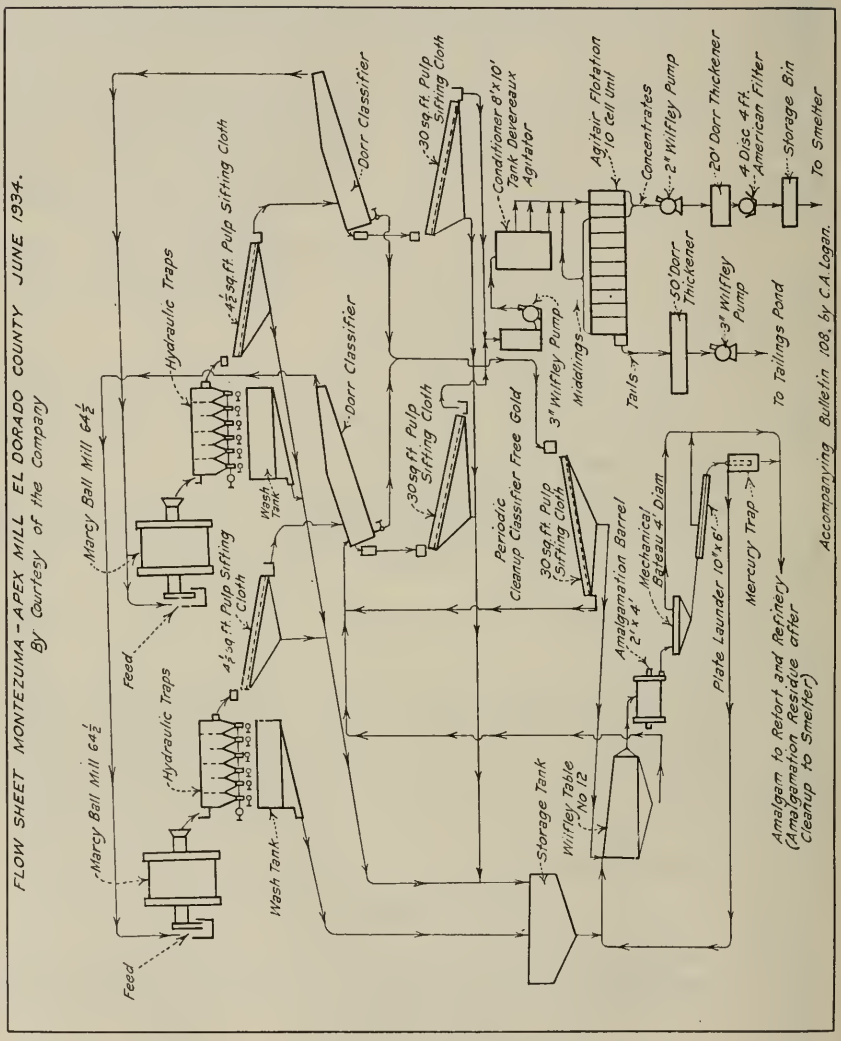
## Montezuma-Apex Mill, El Dorado County, June, 1934

(See Flow Sheet No. 6)

This mill was erected by a company that had no previous experience in treating California Mother Lode ore, but had operated successfully elsewhere. It may be said therefore that California practice or tradition did not influence them. The mill is a complete departure from former local practice. The previous operator had made a reported recovery of about 85% with stamps.

The ore (quartz and Mariposa slate) is very similar to that of the active Amador mines, except that it comes from shallower depths. At times coarse gold occurs, and ample provision for saving this will be noted on the flow-sheet. There is considerable gouge on the footwall side of the vein and this carries enough gold along the ore-shoots to be

Flow Sheet No 6.



milled. The pulp-sifting cloth is an innovation in California. Booth Agitair flotation cells are also used here for the first time on the Mother Lode. They use 2 to 3 lb. air and operate on a pulp of which 99% is –65 mesh and which is about 25% solids. Reagents are amyl zanthate, cresylic acid, Aerofloat 15, copper sulphate and sodium sulphide. About 240 tons of ore was being handled daily in June and a satisfactory recovery was claimed. About 70% of gold is saved by amalgamation and 30% in concentrate, which forms 3% of ore. There is enough arsenic in the ore to necessitate shipping concentrate to a Utah smelter. The total milling cost is among the lowest on the Mother Lode.

Carson Hill Mine, Calaveras County, 1934 (see Flow Sheet No. 7)

This mill is at present handling a large tonnage of low-grade, the company claiming a capacity of 20,000 tons a month. The plant was designed and built in 1919–1920 for the original Carson Hill Gold Mines, Incorporated, and was rehabilitated with some changes in 1933. This mill crushed most of the ore produced by the former company, reaching a capacity of over 15,000 tons a month. The period of operation has not been long enough under the present company to establish average cost figures, but it seems obvious that these must be lower than at other Mother Lode plants. This is due both to the scale of operations and to the fact that a large part of ore is soft, oxidized and earthy material from open pits.

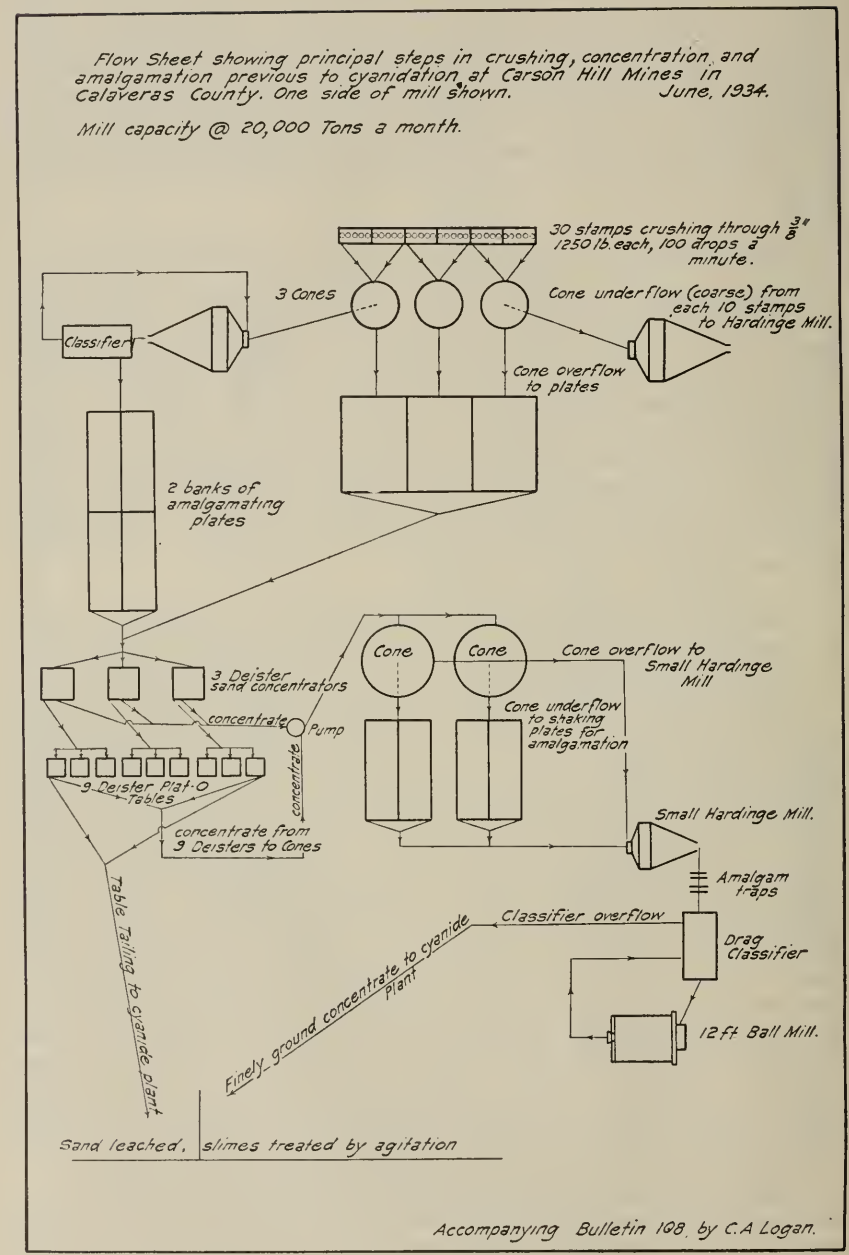
Beebe Mill, El Dorado County, June, 1934 (see Flow Sheet No. 8)

This is an experimental plant and it is quite possible that the flow-sheet shown will have been altered before this report is published.

The Hadsell mill is a recent invention which is here having its first large-scale tryout. As is the rule in nearly all such cases, many unpredictable changes have been required and other alterations are indicated, before this mill can be expected to do justice to its inventor's basic idea. It is essentially a partially enclosed wheel 26 ft. in diameter, revolving at the rate of 2.7 r.p.m. Around its inner periphery is arranged a series of shelves or open ore scoops (see photograph), which at the lower part of the wheel's revolution pass into a sump, where the scoops pick up a load of pulp. Projecting into the space enclosed by the wheel and at the surface of this sump, are the seven heavy steel ore-breaking plates. The mill depends entirely on gravity for ore crushing. As the ore scoops rise from the sump with 600 lb. of ore each the ore begins to slide off as the bottom of each scoop passes the angle of repose for the wet pulp. The ore is crushed by falling a distance of from 11 to 16 ft. upon the breaker plates and the picking up and dropping of ore continues until it is fine enough to be carried off through the screen on the side of the sump, the motion of the buckets through the sump giving enough agitation to prevent packing.

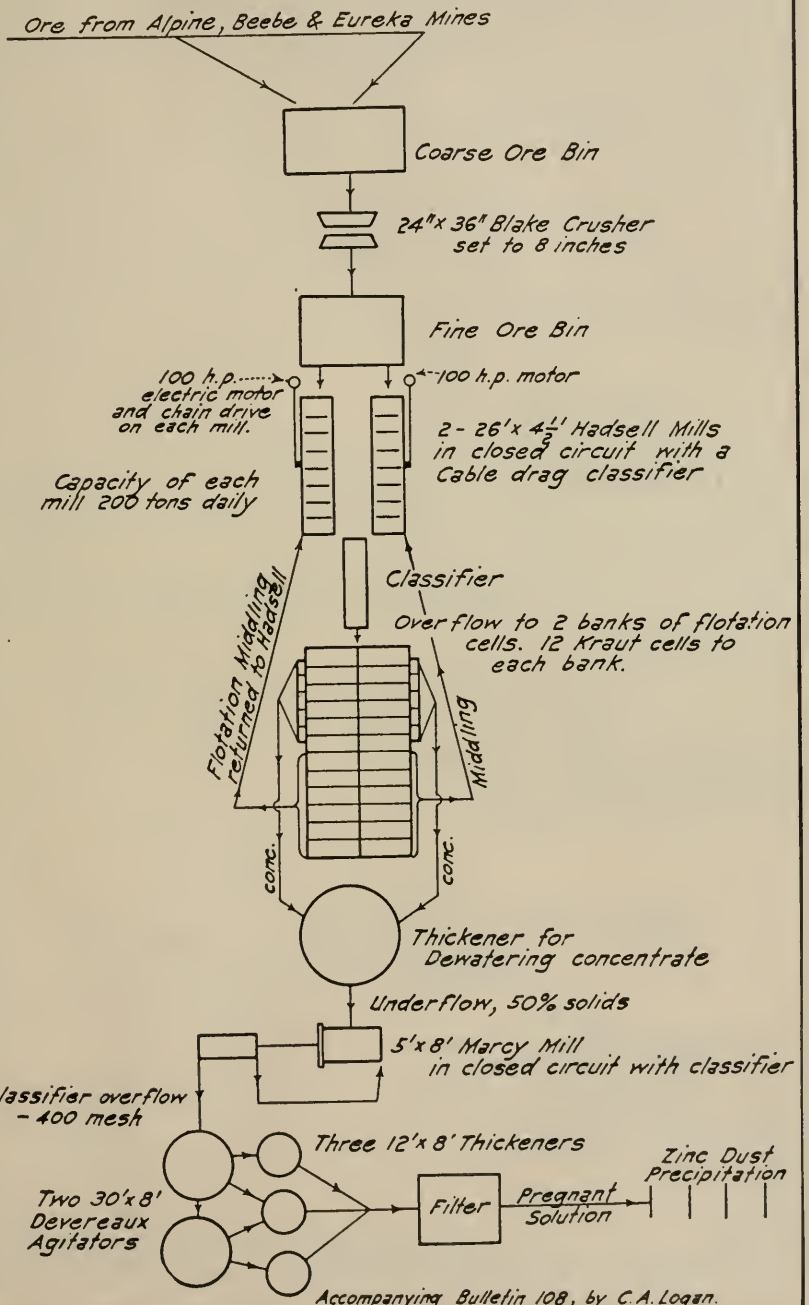
Originally rock as much as one foot in diameter was fed to the mill, but during the last year 6-inch to 8-inch feed has been used. For a time a load of two tons of balls was tried, but these have since been discontinued. In October, 1933, it was said one mill using 85 h.p. was crushing 11.2 tons an hour of which 85% was finer than 200 mesh. The two mills are each run by a motor rated at 100 h.p. which is mounted

Flow Sheet No. 7.


Flow Sheet showing principal steps in crushing, concentration and amalgamation previous to cyanidation at Carson Hill Mines in Calaveras County. One side of mill shown. June, 1934.
Mill capacity @ 20,000 Tons a month.
30 stamps crushing through 3/8" 1250 lb. each, 100 drops a minute.
3 Cones
Cone underflow (coarse) from each 10 stamps to Hardinge Mill.
Classifier
Cone overflow to plates
2 banks of amalgamating plates
Cone
Cone
Cone overflow to Small Hardinge Mill
3 Deister sand concentrators
concentrate
Pump
Cone underflow to shaking plates for amalgamation
9 Deister Plat-O Tables
concentrate
concentrate from 9 Deisters to Cones
Small Hardinge Mill.
Amalgam traps
Classifier overflow
Drag Classifier
Table tailing to cyanide plant
Finely ground concentrate to cyanide plant
12 ft. Ball Mill.
Sand leached, slimes treated by agitation
Accompanying Bulletin 108, by C.A Logan.

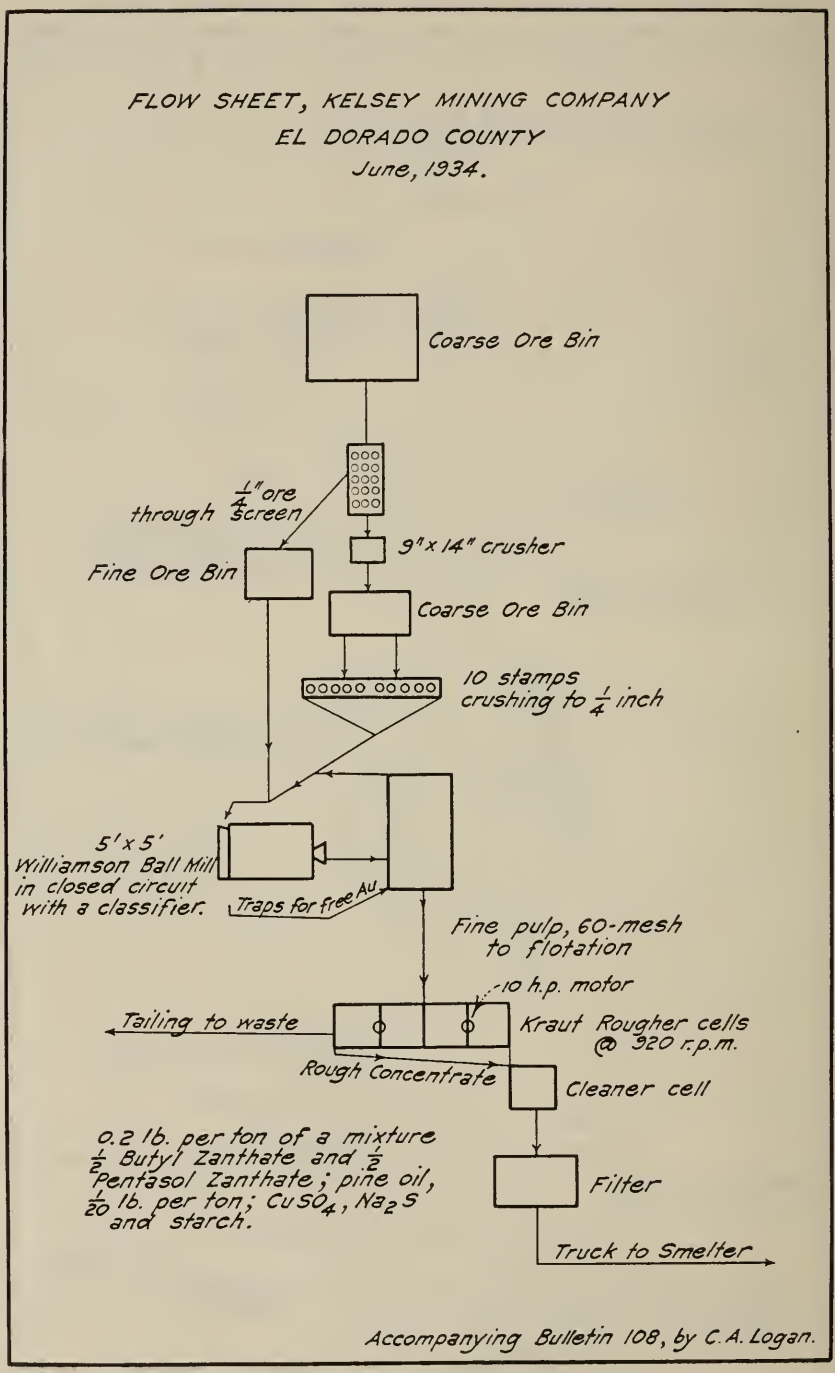
Flow Sheet No. 8.

BEEBE MILL OF PACIFIC MINING COMPANY, GEORGETOWN (1934)
(Flotation & Cyanidation) Courtesy of Roger Dennis, Asst. Supt.


Ore from Alpine, Beebe & Eureka Mines
Coarse Ore Bin
24" x 36" Blake Crusher set to 8 inches
Fine Ore Bin
100 h.p. electric motor and chain drive on each mill.
100 h.p. motor
2 - 26' x 4½' Hadsell Mills in closed circuit with a Cable drag classifier
Capacity of each mill 200 tons daily
Classifier
Flotation Middling returned to Hadsell
Overflow to 2 banks of flotation cells. 12 Kraut cells to each bank.
Middling
conc.
conc.
Thickener for Dewatering concentrate
Underflow, 50% solids
5' x 8' Marcy Mill in closed circuit with classifier
Classifier overflow - 400 mesh
Three 12' x 8' Thickeners
Zinc Dust Precipitation
Two 30' x 8' Devereaux Agitators
Filter
Pregnant Solution

Accompanying Bulletin 108, by C.A. Logan.

Flow Sheet No. 9.


FLOW SHEET, KELSEY MINING COMPANY
EL DORADO COUNTY
June, 1934.
Coarse Ore Bin
1" ore through 1/4 screen
9" x 14" crusher
Fine Ore Bin
Coarse Ore Bin
10 stamps crushing to 1/4 inch
5' x 5' Williamson Ball Mill in closed circuit with a classifier.
Traps for free Au
Fine pulp, 60-mesh to flotation
10 h.p. motor
Tailing to waste
Kraut Rougher cells @ 920 r.p.m.
Rough Concentrate
Cleaner cell
0.2 lb. per ton of a mixture 1/2 Butyl Zanthate and 1/2 Pentasol Zanthate; pine oil, 1/20 lb. per ton; CuSO4, Na2S and starch.
Filter
Truck to Smelter
Accompanying Bulletin 108, by C. A. Logan.

above the mill and runs it by a chain drive. The rated capacity of mills in the flow sheet as illustrated for June was 200 tons each daily.

Another feature of this plant is the cyanidation of flotation concentrate, after grinding to –400 mesh. Combinations of cyanidation and flotation are being used in other parts of the world, though generally to dispose of base-metal sulphides or other cyanicides by flotation previous to cyanidation for gold, rather than bulk flotation of original ore, followed by cyanidation of concentrate as in this case. The combination is indicated (if it can be made technically successful) in this case due to distance from railroad, smelter charges, and grades of ore handled. A maximum recovery of about 85% was claimed in June, 1934, but experimentation is still going on.

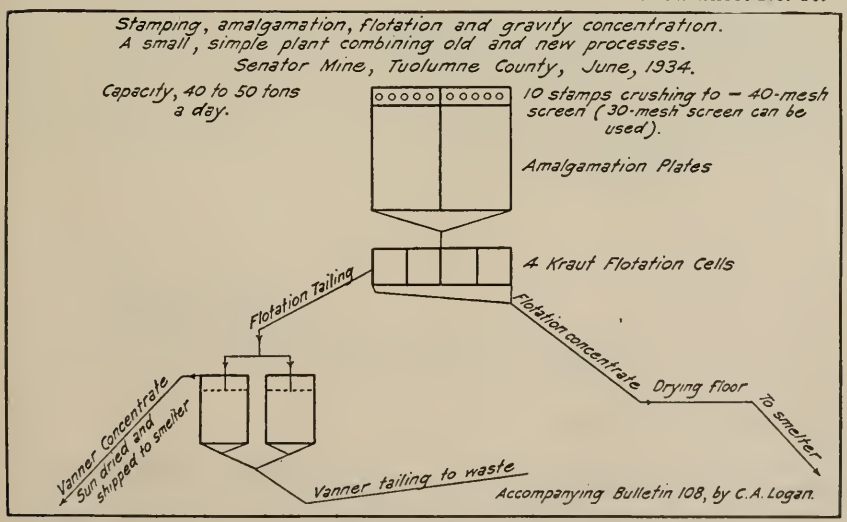
The ores worked in this mill vary greatly in character. That from the Beebe Mine is silicified schist yielding 6½% of concentrate. The Alpine Mine ore is white, sugary quartz carrying free gold and only one-half of 1% of sulphide, and carries over twice as much gold as that from the Beebe. Some oxidized surface ore is worked also from other properties being prospected.

Kelsey Mill, El Dorado County, June, 1934 (see Flow Sheet No. 9)

This mill had just been re-designed and rebuilt at time of visit and had not been given a real working test, so little can be said about its efficiency.

The screening of fine ore ahead of the stamps and the separate fine ore-bin will permit running the ball-mill during stamp shut-downs. The Williamson ball-mill though much used in Arizona, here makes it

Flow Sheet No. 10.

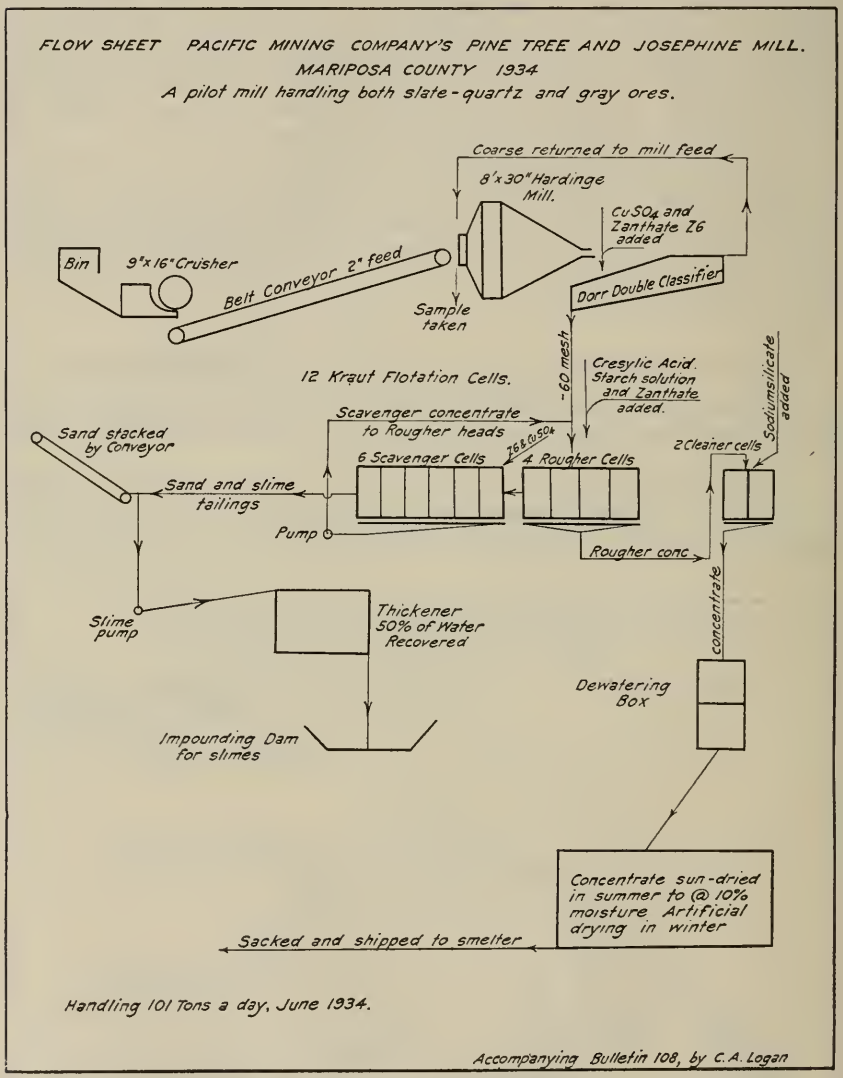

Stamping, amalgamation, flotation and gravity concentration.
A small, simple plant combining old and new processes.
Senator Mine, Tuolumne County, June, 1934.
Capacity, 40 to 50 tons a day.
10 stamps crushing to – 40-mesh screen (30-mesh screen can be used).
Amalgamation Plates
4 Kraut Flotation Cells
Flotation Tailing
Flotation concentrate
Drying floor
To smelter
Vanner Concentrate Sun dried and shipped to smelter
Vanner tailing to waste
Accompanying Bulletin 108, by C.A. Logan.

first appearance on the Mother Lode. Another feature is the new high-speed Kraut flotation machine, running at 920 r.p.m., a pair of machines using 10 h.p.

Senator Mill, Tuolumne County, 1934 (see Flow Sheet No. 10)

This, the only mill in operation on the Mother Lode in Tuolumne County in June, 1934, is a small plant erected to treat ore from shallow levels (100–300 ft.) in the Hitchcock claim, formerly a part of the Dutch-App consolidation.

**Flow Sheet No. 11.**


FLOW SHEET PACIFIC MINING COMPANY'S PINE TREE AND JOSEPHINE MILL.
MARIPOSA COUNTY 1934
A pilot mill handling both slate-quartz and gray ores.
Coarse returned to mill feed
8'x30" Hardinge Mill.
CuSO4 and Zanthate Z6 added
Bin
9"x16" Crusher
Belt Conveyor 2" feed
Sample taken
Dorr Double Classifier
-60 mesh
Cresylic Acid. Starch solution and Zanthate added.
Sodiumsilicate added
12 Kraut Flotation Cells.
Scavenger concentrate to Rougher heads
Z6 & CuSO4
Sand stacked by Conveyor
6 Scavenger Cells
4 Rougher Cells
2 Cleaner cells
Sand and slime tailings
Pump
Rougher conc
concentrate
Slime pump
Thickener 50% of Water Recovered
Dewatering Box
Impounding Dam for slimes
Concentrate sun-dried in summer to @ 10% moisture Artificial drying in winter
Sacked and shipped to smelter
Handling 101 Tons a day, June 1934.
Accompanying Bulletin 108, by C.A. Logan

It illustrates what can be done in a small way and at little expense in combining the old stamp-milling processes with flotation, making both vanner and flotation concentrate and amalgamating free gold.

Ten medium-weight stamps crush 40 to 50 tons daily through 40-mesh screen, but it was planned to install 30-mesh. Most of the

free gold is caught on the plates, though some escapes to be saved by flotation. In the preliminary tests reported by Max Kraut, 44.5% of the gold was saved by amalgamation and 47.4% in the rougher flotation concentrate, with flotation cleaner concentrate giving 4.6% more. In the mill, as shown, 4 Kraut flotation cells are used to take off the first concentrate, and flotation tailing is run over two belt vanners. Both kinds of concentrate are sun-dried and shipped to smelter. In flotation, pine oil, pentasol zanthate Z-6 and Reagent 301 are used, the last named being a powerful zanthate promoter. Sodium silicate is also used in small quantity.

Definite figures of recovery could not be had, but evidently satisfactory results were being obtained.

### Pine Tree and Josephine Mill, Mariposa County, June, 1934

(see Flow Sheet No. 11)

This pilot mill handles both the types of ore common to the Mother Lode, producing a good grade of concentrate for shipment. Though there is nothing complex about the flow-sheet, the differences in the ores from the two mines require some care in flotation and the use of more reagents than usual. The Pine Tree ore, carrying serpentine and talc which tend to froth excessively, requires starch and sodium hydroxide, and copper sulphate must be used later, improving recovery and grade of concentrate. Other reagents used are cresylic acid, zanthate Z6 and sodium silicate. The Josephine ore, carrying fine gold in a gangue composed partly of graphite-bearing black slate is easy to treat by flotation but difficult to cyanide effectively. The concentrate contains over 2% arsenic and 0.25% antimony, also unfavorable to cyanidation. Shipment to a smelter is therefore indicated, and this makes a good grade of concentrate desirable. Accordingly, the product made is considerably higher in gold content than other Mother Lode concentrates. The arsenic content makes it advisable to ship it to Tacoma smelter, where no penalty is assessed against the arsenic.

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| January, 1932, Economic Mineral Deposits of the San Jacinto Quadrangle. Geology and Physical Properties of Building Stone from Carmel Valley. Contributions to the Study of Sediments. Sediments of Monterey Bay. Sanbornite | .25 | .10 |
| **April, 1932. Elementary Placer Mining Methods and Gold Saving Devices. The Pan, Rocker and Sluice Box. Prospecting for Vein Deposits. Bibliography of Placer Mining | ---- | ---- |
| Abstract from April quarterly: Elementary Placer Mining Methods and Gold Saving Devices. Types of Deposits. Simple Equipment. Special Machines. Dry Washing. Black Sand Treatment. Marketing of Products. Placer Mining Areas. Laws. Prospecting for Quartz Veins. Bibliography (mimeographed) | .20 | .05 |
| July-October. (Ventura.) Report accompanying Geologic Map of Northern Sierra Nevada. Fossil Plants in Auriferous Gravels of the Sierra Nevada. Glacial and Associated Stream Deposits of the Sierra Nevada. Jurassic and Cretaceous Divisions in the Knoxville-Shasta Succession of California. Geology of a Part of the Panamint Range. Economic Report of a Part of the Panamint Range. Acquiring Mining Claims Through Tax Title. The Biennial Report of State Mineralogist | .50 | .15 |

## REPORTS—Continued

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| Chapters of Report XXIX, 1933 (quarterly): titled "California Journal of Mines and Geology," containing the following: | | |
| January-April. Gold Deposits of the Redding and Weaverville Quadrangles. Geologic Formations of the Redding-Weaverville District, Northern California. Geology of Portions of Del Norte and Siskiyou Counties. Applications of Geology to Civil Engineering. The Lakes of California. Discovery of Piedmontite in the Sierra Nevada. Tracing 'Buried River' Channel Deposits by Geomagnetic Methods. Geologic Map of Redding-Weaverville District, showing gold mines and prospects. Geologic Map showing various mines and prospects of part of Del Norte and Siskiyou Counties | $0.80 | $0.15 |
| July-October. Gold Resources of Kern County. Limestone Deposits of the San Francisco Region. Limestone Weathering and Plant Associations of the San Francisco Region. Booming. Death Valley National Monument, California. Placer Mining Districts, Senate Bill 480. Navigable Waters, Assembly Bill 1543 | .80 | .10 |
| Chapters of Report XXX, 1934 (quarterly): titled "California Journal of Mines and Geology," containing the following: | | |
| January. Resurrection of Early Surfaces in the Sierra Nevada. Geology and Mineral Resources of Northeastern Madera County. Geology and Mineral Deposits of Laurel and Convict Basins, Southwestern Mono County. Notes on Sampling as Applied to Gold Quartz Deposits | .40 | .10 |
| April-July. Elementary Placer Mining in California and Notes on the Milling of Gold Ores | .80 | .10 |
| Subscription, $1.50 in advance (by calendar year, only). | | |
| Chapters of State Oil and Gas Supervisor's Report: | | |
| Summary of Operations—California Oil Fields, July, 1918, to March, 1919 (one volume) | Free | ---- |
| Summary of Operations—California Oil Fields. Published monthly, beginning April, 1919: | | |
| **April, **May, **June, **July, **August, **September, **October, **November, **December, 1919 | ---- | ---- |
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## BULLETINS

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| **Bulletin No. 3. Gas and Petroleum Yielding Formations of Central Valley of California, by W. L. Watts. 1894, 100 pp., 13 illustrations, 4 maps | ---- | ---- |
| **Bulletin No. 4. Catalogue of Californian Fossils, by J. G. Cooper, 1894, 73 pp., 67 illustrations. (Part I was published in the Seventh Annual Report of the State Mineralogist, 1887) | ---- | ---- |
| **Bulletin No. 5. The Cyanide Process, 1894, by Dr. A. Scheidel. 140 pp., 46 illustrations | ---- | ---- |
| **Bulletin No. 6. California Gold Mill Practices, 1895, by E. B. Preston, 85 pp., 46 illustrations | ---- | ---- |
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| **Bulletin No. 8. Mineral Production of California, by Counties, for the year 1895, by Charles G. Yale. Tabulated sheet | ---- | ---- |
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| **Bulletin No. 10. A bibliography Relating to the Geology, Paleontology and Mineral Resources of California, by Anthony W. Vogdes. 1896, 121 pp. | ---- | ---- |
| **Bulletin No. 11. Oil and Gas Yielding Formations of Los Angeles, Ventura and Santa Barbara Counties, by W. L. Watts. 1897, 94 pp., 6 maps, 31 illustrations | ---- | ---- |
| **Bulletin No. 12. Mineral Production of California, by Counties, for 1896, by Charles G. Yale. Tabulated sheet | ---- | ---- |
| **Bulletin No. 13. Mineral Production of California, by Counties, for 1897, by Charles G. Yale. Tabulated sheet | ---- | ---- |
| **Bulletin No. 14. Mineral Production of California, by Counties, for 1898, by Charles G. Yale | ---- | ---- |
| **Bulletin No. 15. Map of Oil City Fields, Fresno County, by John H. Means, 1899 | ---- | ---- |
| **Bulletin No. 16. The Genesis of Petroleum and Asphaltum in California, by A. S. Cooper. 1899, 39 pp., 29 illustrations | ---- | ---- |
| **Bulletin No. 17. Mineral Production of California, by Counties, for 1899, by Charles G. Yale. Tabulated sheet | ---- | ---- |
| **Bulletin No. 18. Mother Lode Region of California, by W. H. Storms. 1900, 154 pp., 49 illustrations | ---- | ---- |
| **Bulletin No. 19. Oil and Gas Yielding Formations of California, by W. L. Watts. 1900, 236 pp., 60 illustrations, 8 maps | ---- | ---- |
| **Bulletin No. 20. Synopsis of General Report of State Mining Bureau, by W. L. Watts. 1901. 21 pp. This bulletin contains a brief statement of the progress of the mineral industry in California for the four years ending December, 1899 | ---- | ---- |
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| **Bulletin No. 25. Mineral Production of California, by Counties, for 1901, by Charles G. Yale. Tabulated sheet | ---- | ---- |
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| **Bulletin No. 31. Chemical Analyses of California Petroleum, by H. N. Cooper. 1904. Tabulated sheet | ---- | ---- |
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| **Bulletin No. 39. Mineral Production of California, by Counties, for 1904, by Charles G. Yale. Tabulated sheet | ---- | ---- |
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| **Bulletin No. 42. Mineral Production of California, by Counties, 1905, by Charles G. Yale. Tabulated sheet | ---- | ---- |
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| **Bulletin No. 51. Mineral Production of California, by Counties, 1907, by D. H. Walker. Tabulated sheet | ---- | ---- |
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| **Bulletin No. 73. First Annual Report of the State Oil and Gas Supervisor of California, for the Fiscal Year 1915–16, by R. P. McLaughlin. 278 pp., 26 illustrations | ---- | ---- |
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| **Bulletin No. 96. California Mineral Production for 1924, by Walter W. Bradley. 1925, 173 pp., paper | ---- | ---- |
| **Bulletin No. 97. California Mineral Production for 1925, by Walter W. Bradley. 1926, 172 pp., paper | ---- | ---- |
| Bulletin No. 98. American Mining Law, by A. H. Ricketts, 1931, 811 pp., flexible leather | 3.00 | .15 |
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| Bulletin No. 103. California Mineral Production for 1929, by Henry H. Symons, 1930. 231 pp., paper | .25 | .10 |
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| **Preliminary Report No. 7. The Clay Industry in California. By E. S. Boalich, W. O. Castello, E. Huguenin, C. A. Logan, and W. B. Tucker, 1920. 102 pp. 24 illustrations. Paper | ---- | ---- |
| **Preliminary Report No. 8. A Review of Mining in California During 1921, with Notes on the Outlook for 1922. By Fletcher Hamilton, 1922. 68 pp. Paper | ---- | ---- |

## MISCELLANEOUS PUBLICATIONS

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| **First Annual Catalogue of the State Museum of California, being the collection made by the State Mining Bureau during the year ending April 16, 1881. 350 pp. | ---- | ---- |
| **Catalogue of books, maps, lithographs, photographs, etc., in the library of the State Mining Bureau at San Francisco, May 15, 1884. 19 pp. | ---- | ---- |
| **Catalogue of the State Museum of California, Volume II, being the collection made by the State Mining Bureau from April 16, 1881, to May 5, 1884. 220 pp. | ---- | ---- |
| **Catalogue of the State Museum of California, Volume III, being the collection made by the State Mining Bureau from May 15, 1884, to March 31, 1887. 195 pp. | ---- | ---- |
| **Catalogue of the State Museum of California, Volume IV, being the collection made by the State Mining Bureau from March 30, 1887, to August 20, 1890. 261 pp. | ---- | ---- |
| **Catalogue of the Library of the California State Mining Bureau, September 1, 1892. 149 pp. | ---- | ---- |
| **Catalogue of West North American and Many Foreign Shells with Their Geographical Ranges, by J. G. Cooper. Printed for the State Mining Bureau, April, 1894 | ---- | ---- |
| **Report of the Board of Trustees for the four years ending September, 1900. 15 pp. Paper | ---- | ---- |
| Bulletin. Reconnaissance of the Colorado Desert Mining District. By Stephen Bowers, 1901. 19 pp. 2 illustrations. Paper | $0.10 | ---- |
| Commercial Mineral Notes. A monthly mimeographed sheet, beginning April, 1923 | Free | .15 |

## MAPS

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| **Register of Mines, with Map, San Bernadino County | ---- | ---- |
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| Register of Mines, with Map, Santa Barbara County (1906) | .25 | .05 |
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## OTHER MAPS

| | | |
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| **Map of Forest Reserves in California | ---- | ---- |
| **Mineral and Relief Map of California | ---- | ---- |
| **Map of El Dorado County, Showing Boundaries, National Forests | ---- | ---- |
| **Map of Madera County, Showing Boundaries, National Forests | ---- | ---- |
| **Map of Placer County, Showing Boundaries, National Forests | ---- | ---- |
| **Map of Shasta County, Showing Boundaries, National Forests | ---- | ---- |
| **Map of Sierra County, Showing Boundaries, National Forests | ---- | ---- |
| **Map of Siskiyou County, Showing Boundaries, National Forests | ---- | ---- |
| **Map of Tuolumne County, Showing Boundaries, National Forests | ---- | ---- |
| **Map of Mother Lode Region | ---- | ---- |
| **Map of Desert Region of Southern California | ---- | ---- |
| Map of Minaret District, Madera County | .20 | .05 |
| Map of Copper Deposits in California | .05 | ---- |
| **Map of Calaveras County | ---- | ---- |
| **Map of Plumas County | ---- | ---- |
| **Map of Trinity County | ---- | ---- |
| **Map of Tuolumne County | ---- | ---- |
| Geological Map of Inyo County. Scale 1 inch equals 4 miles | .60 | .05 |
| **Map of California accompanying Bulletin No. 89, showing generalized classification of land with regard to oil possibilities. Map only, without Bulletin | ---- | ---- |
| Geological Map of California, 1916. Scale 1 inch equals 12 miles. As accurate and up-to-date as available data will permit as regards topography and geography. Shows railroads, highways, post offices and other towns. First geological map that has been available since 1892, and shows geology of entire state as no other map does. Geological details lithographed in 23 colors. Unmounted | .75 | .05 |
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| **Topographic Map of Sierra Nevada Gold Belt, showing distribution of auriferous gravels, accompanying Bulletin No. 92. In 4 colors (also sold singly) | ---- | ---- |

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| Geologic Map of Northern Sierra Nevada, showing Tertiary River Channels and Mother Lode Belt, accompanying July-October Chapter of Report XXVIII of the State Mineralogist. (Sold singly) | $0.25 | $0.05 |
| Map of Northern California, showing rivers and creeks which produced placer gold in 1932 | .20 | .05 |

## OIL FIELD MAPS

(Apply to Division of Oil and Gas, Ferry Building, San Francisco.)

## DETERMINATION OF MINERAL SAMPLES

Samples (limited to one at one time) of any mineral found in the State may be sent to the Division of Mines for identification, and the same will be classified free of charge. No samples will be determined if received from points outside the State. It must be understood that no assays, or quantitative determinations will be made. Samples should be in lump form if possible, and marked plainly with name of sender on outside of package, etc. No samples will be received unless delivery charges are prepaid. A letter should accompany sample, giving locality where mineral was found and the nature of the information desired.

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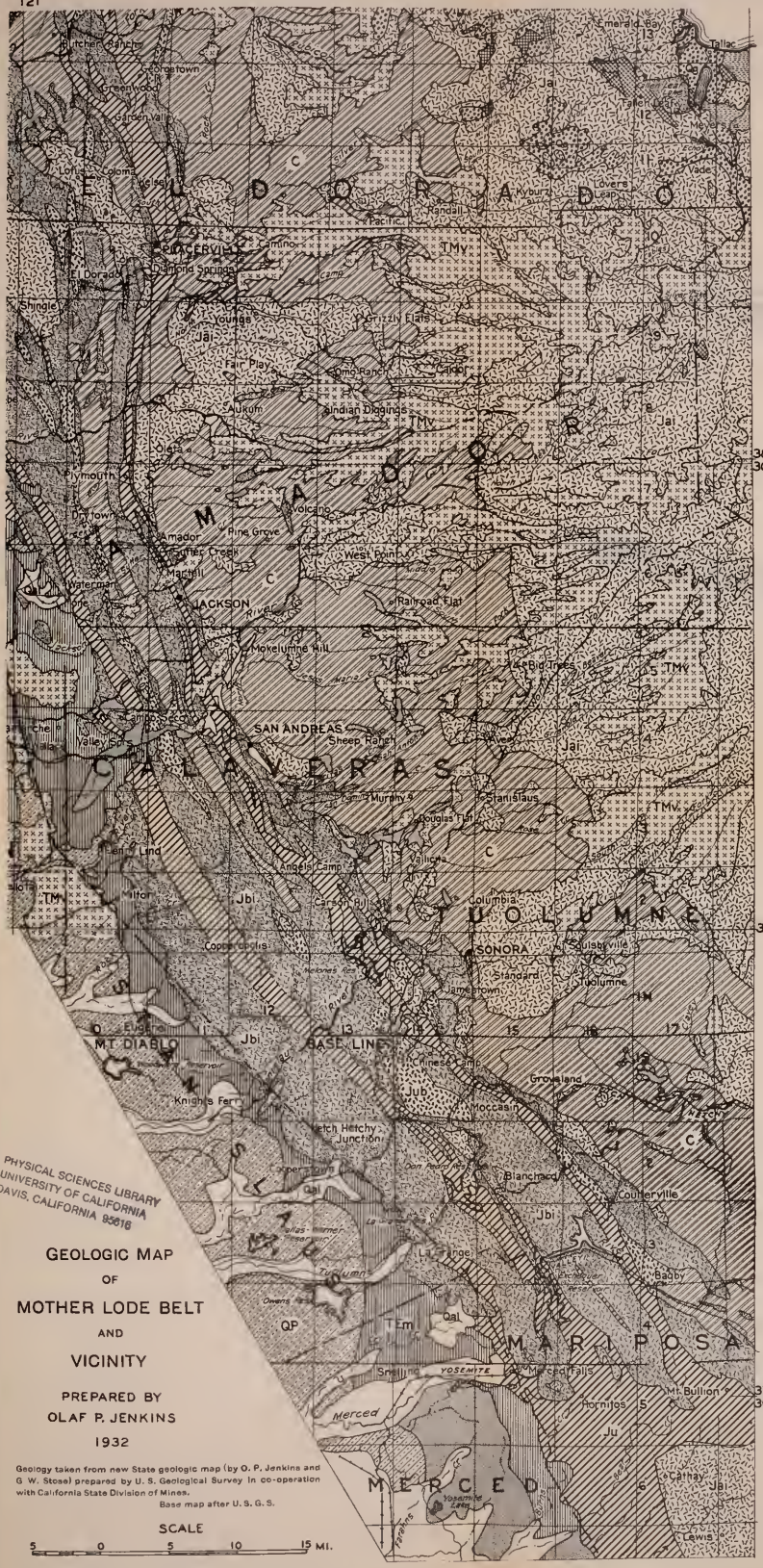


## LEGEND

**Quaternary**

- **Qal** — *Alluvium*
- **Ql** — *Lacustrine and playa deposits*
- **Qt** — *Terrace alluvial deposits*
- **Qg** — *Glacial deposits (moraines, etc.)*
- **Qv** — *Chiefly Pleistocene volcanics (chiefly basalt)*

**Tertiary**

- **QP** — *Pliocene: Quaternary and upper Pliocene sediments (chiefly non-marine deposits)*
- **TMv** — *Miocene: Miocene volcanics and continental deposits (lava flows and tuffs of rhyolite, basalt, latite, and andesite)*
- **Tg** — *Tertiary stream gravel deposits (for the most part early Tertiary in age.)*
- **TEm** — *Eocene: Eocene marine deposits (Tejon formation)*

**Jurassic**

- **Jai** — *Upper Jurassic: Acidic intrusives (granite, granodiorite, gabbro, etc.)*
- **Jbi** — *Basic intrusives (diabase, amphibolite and hornblende schist)*
- **Jub** — *Ultra-basic intrusives (peridotite, pyroxenite, serpentine, etc.)*
- **Ju** — *Upper Jurassic marine deposits (chiefly Mariposa formation)*

**Triassic**

- **JTr** — *Jurassic and Triassic volcanic and sedimentary rocks (includes about 16 individual formations)*

**Carboniferous**

- **C** — *Pennsylvanian and Mississippian sedimentary and igneous rocks (includes the Robinson formation, Calaveras group and other rocks of the Carboniferous period)*

# GEOLOGIC MAP OF MOTHER LODE BELT AND VICINITY

PREPARED BY
OLAF P. JENKINS
1932

Geology taken from new State geologic map (by O. P. Jenkins and G. W. Stose) prepared by U. S. Geological Survey in co-operation with California State Division of Mines.

Base map after U. S. G. S.

SCALE

5 0 5 10 15 MI.

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| NO. | SEC. | NAME OF MINE |
|---|---|---|
| 10 | 11 | RED HILL |
| 11 | 12 | OLD JUDGE |
| 12 | 12 | MARY ANN |
| 13 | 12 | HARRISON |
| 14 | 12 | HOPE |
| 15 | 12 | WASHINGTON |
| 16 | 12 | CRYSTAL |
| 17 | 12, 13 | IDA LIVINGSTONE |
| 18 | 13 | CURRIE (LADY EMMA) |
| 19 | 11, 14 | YOUNG AMERICA |
| 20 | 14 | ST. CLAIR |
| 21 | 14, 11 | GOPHER BOULDER |
| 22 | 14, 11 | RISING SUN |
| 23 | 10 | RUSSIAN-AMERICAN |
| 24 | 10 | UNITED STATES |
| 25 | 10 | N EX ROCKY BEND |
| 26 | 10 | ROCKY BEND |
| 27 | 10, 15 | SWANSEA |
| 28 | 8, 17 | LAST CHANCE |

T. 10 N. R. 11 E.

| NO. | SEC. | NAME OF MINE |
|---|---|---|
| 1 | 6, 36 | INDEPENDENT |
| 2 | 6 | BONA SORTE |
| 3 | 6 | GENTLE ANNIE |
| 4 | 6, 36 | LOGAN |
| 5 | 6, 36 | EUREKA |
| 6 | 6 | LION |
| 7 | 6 | GROSS NO. 1 |
| 8 | 6 | GROSS NO. 2 |
| 9 | 6 | SHERMAN |
| 10 | 6 | WITTMER |
| 11 | 6 | WELLINGTON |
| 12 | 6 | GRANT |
| 13 | 6 | VAN HOOKER |
| 14 | 6, 7 | HALLECK |
| 15 | 6, 7 | OLD HARMON |
| 16 | 7 | YOUNG HARMON |
| 17 | 7 | ENTERPRISE |
| 18 | 7 | GERMAN |
| 19 | 7 | DAVEY |
| 20 | 7 | KEEGAN |
| 21 | 7, 18 | CHESTER |
| 22 | 7, 18 | PACIFIC |
| 23 | 18 | ROSE |
| 24 | 18 | IDA |
| 25 | 18, 17 | MARYLAND |
| 26 | 17 | ATLANTIC |
| 27 | 18 | OREGON |
| 28 | 21 | YELLOW JACKET |
| 29 | 20 | FARRADAY |
| 30 | 20 | EPLEY |
| 31 | 20 | HENRIETTA |
| 32 | 20 | WEBBER |
| 33 | 20 | RIBBON ROCK |
| 34 | 20, 14, 30 | CINCINNATI |
| 35 | 20, 29, 30 | SUPERIOR |
| 36 | 29 | MARGUERITE |
| 37 | 29 | LARKIN |
| 38 | 30 | LIVE OAK |
| 39 | 30 | CONCORDIA |
| 40 | 30, 31 | GRIFFITH & BRYANT |
| 41 | 31 | MANZANITA KING |
| 42 | 31 | MANZANITA QUEEN |
| 43 | 31 | ORO FLEM (ORIFLAMME) |
| 44 | 31 | LONE STAR |
| 45 | 31, 6 | LONE STAR EX. |
| 46 | 31 | SCHNEIDER & CO. |
| 47 | 33, 39 | GRAND VICTORY |
| 48 | 33, 39 | SALISBURRY |
| 49 | 20 | RATTLER |
| 50 | 20, 29 | KEYSTONE |
| 51 | 30 | CHAMPION |
| 52 | 21 | ECHO |
| 53 | 29 | SELBY |
| 54 | 20 | EDEN |
| 55 | 20 | ESSEX |
| 56 | | |
| 57 | 30 | POTOSI |
| 58 | 31 | ALICE "B" |
| 59 | 31 | CHOLLAR |
| 60 | 31 | BULLION |
| 61 | 29 | KEYSTONE |
| 62 | 29 | RINGOLD |
| 63 | 31 | CROWN POINT CONS. |
| 64 | 31 | CROWN POINT CONS. |
| 65 | 31 | EAST MOTHER LODE |
| 66 | 6 | LUCKY STAR CONS. |
| 67 | 6 | MCKINLEY GOLD STANDARD |
| 68 | 6 | ELECTRIC |
| 69 | 6 | LUCKY |
| 70 | 6 | HALL CONSOLIDATED |
| 71 | 6 | GARDNER CONSOLIDATED |
| 72 | 6 | LION |
| 73 | 6 | KEYSTONE |
| 74 | 6 | EUREKA |
| 75 | 6 | NEW ERA |
| 76 | 31 | PRINCESS |
| 77 | 31 | HAPPY-GO-LUCKY |

T 10 N. R. 10 E.

| NO. | SEC. | NAME OF MINE |
|---|---|---|
| 1 | 4 | HILL OTZ |
| 2 | 4 | HILL OTZ |
| 3 | 4 | WEBB |
| 4 | 17 | RUDOLPH & GILLESPIE |
| 5 | 19 | SUNDRY G & S |
| 6 | 21 | SHAW |
| 7 | 27 | DAVIDSON |
| 8 | 28 | EUREKA |
| 9 | 28, 33 | BARNES |
| 10 | 27 | WESTERN STAR |
| 11 | 22 | GLINES |
| 12 | 27, 28 | LITTLE GIANT |
| 13 | 27 | LIVERPOOL |
| 14 | 32 | NORTH STAR |
| 15 | | GENERAL LEE |
| 16 | | GOLDEN AGE |
| 17 | | BOSQUIT |
| 18 | | BOSQUIT |
| 19 | | CENTRAL EL DORADO |
| 20 | | JERSEY |
| 21 | | LITTLE GIANT |

T. 9 N. R. 10 E.

| NO. | SEC. | NAME OF MINE |
|---|---|---|
| 1 | 1 | TULLIS |
| 2 | 1, 12 | RICHELIEU |
| 3 | 12 | GOLDEN FLEECE |
| 4 | 12 | EL DORADO (CHURCH) |
| 5 | 12 | VERNON (OLDS) |
| 6 | 12 | SPRINGFIELD |
| 7 | 12, 13 | JULIA BEARD |
| 8 | 11 | LAMOILLE |
| 9 | 11 | OPHIR |
| 10 | 11, 10, 15 | POCAHONTAS |
| 11 | 10 | STARLIGHT |
| 12 | 10, 3 | INDEPENDENCE |
| 13 | 18 | ERYSTAL |
| 14 | 18 | CRYSTAL |
| 15 | 14 | GERMAN |
| 16 | 14, 28 | OAKLAND |
| 17 | 26 | VANDERGRIFT |
| 18 | 27 | MONARCH |
| 19 | 19 | VANDALIA |
| 20 | 29 | BIG CANON (ORO FINE) |
| 21 | 29, 32 | MONTEZUMA |
| 22 | 35, 2 | |
| 23 | 36 | MCDOWELL |
| 24 | | & WILTSHIRE |
| 25 | 1 | |
| 26 | 12 | |
| 27 | 12, 13 | |
| 28 | 12, 13 | JEANNETTE |
| 29 | 12 | PINE TREE |
| 30 | 14 | RICHARDS |
| 31 | 13, 24 | BUENA VISTA |
| 32 | | MOHAWK |
| 33 | | LOOKOUT |
| 34 | | SANTA YNEZ |
| 35 | 12 | SCHOOLGIRL MG. CO. |
| 36 | 12 | ADJUSTER |
| 37 | 12 | HUSTLER |
| 38 | 12 | GOLD TOP |
| 39 | 12, 13 | BISMARK |
| 40 | 12 13 | SANTA FE |
| 41 | 13 | CLIMAX |
| 42 | 13 | GOLD REEF |
| 43 | 13 | HILLSIDE EXT. |
| 44 | 13 | MARTINEZ |
| 45 | 13 | HILLSIDE EXT. NO. 1 |
| 46 | 13 | MOON |
| 47 | 13 | OLD ABE |
| 48 | 13 | LONE STAR |
| 49 | 13 | WILD ROSE |

T. 8 N. R. 10 E.

| NO. | SEC. | NAME OF MINE |
|---|---|---|
| 1 | 2 | NASHVILLE (HAVILAH) |
| 2 | 2 | CALIFORNIA (HAVILAH) |
| 3 | 1 | CENTRAL |
| 4 | 1, 12 | NASHVILLE (BALDWIN) |
| 5 | 11 | LONE STAR |
| 6 | 2 | MONITOR |
| 7 | 2 | MONTEZUMA |
| 8 | 1 | WASHINGTON |
| 9 | 1 | LAST CHANCE |
| 10 | 12 | NOME |
| 11 | 1 | OREGON |
| 12 | 12 | COLUMBIA |
| 13 | 1, 12 | PORTLAND |
| 14 | 12 | WILLAMETTE |
| 15 | 12 | LOT 4716 (KERCHEVAL) |
| 16 | 11 | CONFIDENCE |
| 17 | 11 | LOST PACK SADDLE |
| 18 | 11 | MECHANICS LODE |
| 19 | 11 | PACK HORSE LODE |
| 20 | 2 | LENA B. LODE |
| 21 | 2 | GOLD MOUNTAIN |
| 22 | | NASHVILLE PLACER |

T. 11 N. R. 11 E.

| NO. | SEC. | NAME OF MINE |
|---|---|---|
| 1 | 6 | BLUE LEDGE |
| 2 | 6, 7 | ALHAMBRA |
| 3 | 7 | ATLANTIC |
| 4 | 20 | JENNINGS |
| 5 | 20 | WILFRED |
| 6 | 20, 19 | N EX-JENNINGS |
| 7 | 19 | NOWARD |
| 8 | 31 | GROVER CLEVELAND "LAMONT" |

Gold Hill
Webber
Hangtown Cr.
PLACERVILLE
Smiths Flat
Indian Creek
Deadman
T10N. R10E.
T10N. R11E.
Diamond Springs
Eldorado
S. P. R. R.
Squaw Hollow
Logtown
Mathews Cr.
T9N. R10E.
T9N. R11E.
Canon
Slate
North Fork
Cosumnes River
Nashville
Middle Fork
T8N. R11E.
South Fork
T8N. R10E.
EL DORADO CO.
AMADOR CO.

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# MAP OF MOTHER LODE GOLD BELT IN EL DORADO COUNTY

SHOWING

MINING CLAIMS AND AREAL GEOLOGY

1934

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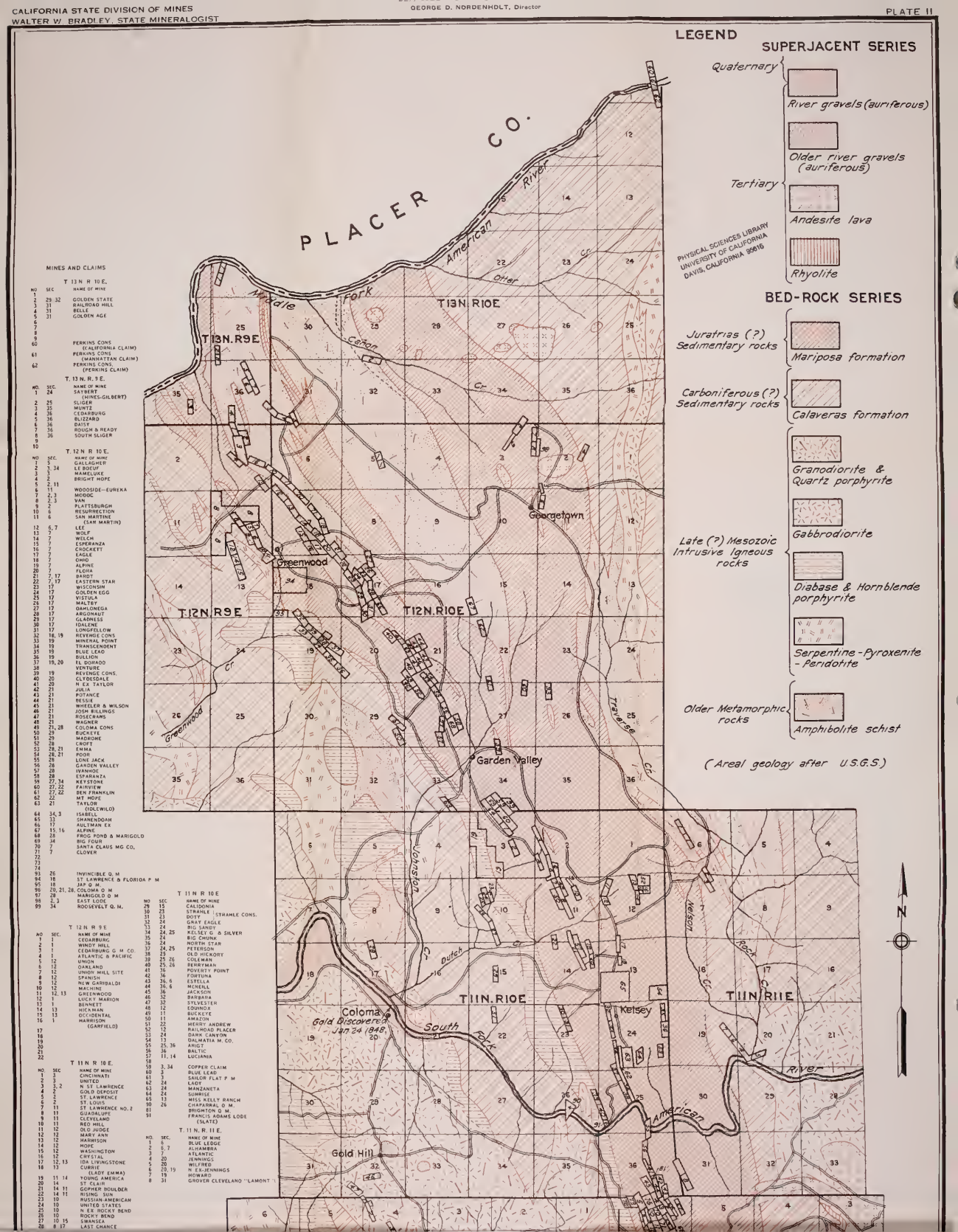
ACCOMPANYING BULLETIN 108, BY C.A. LOGAN.

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MINES AND CLAIMS

T 13 N R 10 E.

| NO | SEC | NAME OF MINE |
|---|---|---|
| 1 | | GOLDEN STATE |
| 2 | 29, 32 | RAILROAD HILL |
| 3 | 31 | BELLE |
| 4 | 31 | GOLDEN AGE |
| 5 | | |
| 6 | | |
| 7 | | |
| 8 | | |
| 9 | | |
| 60 | | PERKINS CONS (CALIFORNIA CLAIM) |
| 61 | | PERKINS CONS (MANHATTAN CLAIM) |
| 62 | | PERKINS CONS. (PERKINS CLAIM) |

T. 13 N. R. 9 E.

| NO. | SEC. | NAME OF MINE |
|---|---|---|
| 1 | 24 | SAYBERT (HINES-GILBERT) |
| 2 | 25 | SLIGER |
| 3 | 35 | MUNTZ |
| 4 | 36 | CEDARBURG |
| 5 | 36 | BLIZZARD |
| 6 | 36 | DAISY |
| 7 | 36 | ROUGH & READY |
| 8 | 36 | SOUTH SLIGER |
| 9 | | |
| 10 | | |

T. 12 N R 10 E.

| NO | SEC. | NAME OF MINE |
|---|---|---|
| 1 | 5 | GALLAGHER |
| 2 | 3, 34 | LE BOEUF |
| 3 | 3 | MAMELUKE |
| 4 | 2 | BRIGHT HOPE |
| 5 | 2, 11 | |
| 6 | 11 | WOODSIDE--EUREKA |
| 7 | 2, 3 | MODOC |
| 8 | 2, 3 | VAN |
| 9 | 2 | PLATTSBURGH |
| 10 | 6 | RESURRECTION |
| 11 | 6 | SAN MARTINE (SAM MARTIN) |
| 12 | 6, 7 | LEE |
| 13 | 7 | WOLF |
| 14 | 7 | WELCH |
| 15 | 7 | ESPERANZA |
| 16 | 7 | CROCKETT |
| 17 | 7 | EAGLE |
| 18 | 7 | OHIO |
| 19 | 7 | ALPINE |
| 20 | 7 | FLORA |
| 21 | 7, 17 | BARDT |
| 22 | 7, 17 | EASTERN STAR |
| 23 | 17 | WISCONSIN |
| 24 | 17 | GOLDEN EGG |
| 25 | 17 | VISTULA |
| 26 | 17 | MALTBY |
| 27 | 17 | OAHLONEGA |
| 28 | 17 | ARGONAUT |
| 29 | 17 | GLADNESS |
| 30 | 17 | IDALENE |
| 31 | 17 | LONGFELLOW |
| 32 | 16, 19 | REVENGE CONS |
| 33 | 19 | MINERAL POINT |
| 34 | 19 | TRANSCENDENT |
| 35 | 19 | BLUE LEAD |
| 36 | 19 | BULLION |
| 37 | 19, 20 | EL DORADO |
| 38 | | VENTURE |
| 39 | 19 | REVENGE CONS. |
| 40 | 20 | CLYDESDALE |
| 41 | 20 | N EX TAYLOR |
| 42 | 21 | JULIA |
| 43 | 21 | POTANCE |
| 44 | 21 | BESSIE |
| 45 | 21 | WHEELER & WILSON |
| 46 | 21 | JOSH BILLINGS |
| 47 | 21 | ROSECRANS |
| 48 | 21 | WAGNER |
| 49 | 21, 28 | COLOMA CONS |
| 50 | 29 | BUCKEYE |
| 51 | 29 | MADRONE |
| 52 | 28 | CROFT |
| 53 | 28, 21 | EMMA |
| 54 | 28, 21 | POOR |
| 55 | 28 | LONE JACK |
| 56 | 28 | GARDEN VALLEY |
| 57 | 28 | IVANHOE |
| 58 | 28 | ESPARANZA |
| 59 | 27, 34 | KEYSTONE |
| 60 | 27, 22 | FAIRVIEW |
| 61 | 27, 22 | BEN FRANKLIN |
| 62 | 22 | MT HOPE |
| 63 | 21 | TAYLOR (IDLEWILD) |
| 64 | 34, 3 | ISABELL |
| 65 | 33 | SMANENDOAH |
| 66 | 17 | AULTMAN EX |
| 67 | 15, 16 | ALPINE |
| 68 | 28 | FROG POND & MARIGOLD |
| 69 | 34 | BIG FOUR |
| 70 | 7 | SANTA CLAUS MG CO. |
| 71 | 7 | CLOVER |
| 72 | | |
| 73 | | |
| 74 | | |
| 93 | 26 | INVINCIBLE Q. M |
| 94 | 18 | ST LAWRENCE & FLORIDA P M |
| 95 | 18 | JAP Q M. |
| 96 | 20, 21, 28 | COLOMA Q M |
| 97 | 28 | MARIGOLD Q M |
| 98 | 2, 3 | EAST LODE |
| 99 | 34 | ROOSEVELT Q. M. |

T 12 N R 9 E

| NO | SEC. | NAME OF MINE |
|---|---|---|
| 1 | 1 | CEDARBURG |
| 2 | 1 | WINDY HILL |
| 3 | 1 | CEDARBURG Q M CO |
| 4 | 1 | ATLANTIC & PACIFIC |
| 5 | 12 | UNION |
| 6 | 12 | OAKLAND |
| 7 | 12 | UNION MILL SITE |
| 8 | 12 | SPANISH |
| 9 | 12 | NEW GARIBALDI |
| 10 | 12 | MACHINE |
| 11 | 12, 13 | GREENWOOD |
| 12 | | LUCKY MARION |
| 13 | 1 | BENNETT |
| 14 | 13 | HICKMAN |
| 15 | 13 | OCCIDENTAL |
| 16 | 1 | MARRISON (GARFIELD) |
| 17 | | |
| 18 | | |
| 19 | | |
| 20 | | |
| 21 | | |
| 22 | | |

T 11 N R 10 E.

| NO. | SEC | NAME OF MINE |
|---|---|---|
| 1 | 3 | CINCINNATI |
| 2 | 3 | UNITED |
| 3 | 3, 2 | N ST LAWRENCE |
| 4 | 2 | GOLD DEPOSIT |
| 5 | 2 | ST. LAWRENCE |
| 6 | 2 | ST. LOUIS |
| 7 | 11 | ST. LAWRENCE NO. 2 |
| 8 | 11 | GUADALUPE |
| 9 | 11 | CLEVELAND |
| 10 | 11 | RICO HILL |
| 11 | 12 | OLD JUDGE |
| 12 | 12 | MARY ANN |
| 13 | 12 | HARRISON |
| 14 | 12 | HOPE |
| 15 | 12 | WASHINGTON |
| 16 | 12 | CRYSTAL |
| 17 | 12, 13 | IDA LIVINGSTONE |
| 18 | 13 | CURRIE (LADY EMMA) |
| 19 | 11, 14 | YOUNG AMERICA |
| 20 | 14 | ST. CLAIR |
| 21 | 14, 11 | GOPHER BOULDER |
| 22 | 14, 11 | RISING SUN |
| 23 | 10 | RUSSIAN-AMERICAN |
| 24 | 10 | UNITED STATES |
| 25 | 10 | N EX ROCKY BEND |
| 26 | 10 | ROCKY BEND |
| 27 | 10, 15 | SWANSEA |
| 28 | 8, 17 | LAST CHANCE |

T 11 N R 10 E

| NO | SEC | NAME OF MINE |
|---|---|---|
| 29 | 15 | CALIDONIA |
| 30 | 23 | STRAHLE \| STRAMLE CONS. |
| 31 | 23 | DOSY |
| 32 | 24 | GRAY EAGLE |
| 33 | 24 | BIG SANDY |
| 34 | 24, 25 | KELSEY G & SILVER |
| 35 | 24 | BIG CHUNK |
| 36 | 24 | NORTH STAR |
| 37 | 24, 25 | PETERSON |
| 38 | 25 | OLD HICKORY |
| 39 | 25, 26 | COLEMAN |
| 40 | 25, 26 | PERRYMAN |
| 41 | 36 | POVERTY POINT |
| 42 | 36 | FORTUNA |
| 43 | 36, 6 | ESTELLA |
| 44 | 36, 6 | MCNEAL |
| 45 | 36 | JACKSON |
| 46 | 32 | BARBARA |
| 47 | 32 | SYLVESTER |
| 48 | 12 | CONNOR |
| 49 | 11 | BUCKEYE |
| 50 | 11 | AMAZON |
| 51 | 22 | MERRY ANDREW |
| 52 | 12 | RAILROAD PLACER |
| 53 | 24 | DARK CANYON |
| 54 | 13 | DALMATIA M. CO. |
| 55 | 25, 36 | ARIGT |
| 56 | 36 | BALTIC |
| 57 | 11, 14 | LUCIANIA |
| 58 | | |
| 59 | 3, 34 | COPPER CLAIM |
| 60 | 3 | BLUE LEAD |
| 61 | 3 | SAILOR FLAT P M |
| 62 | 24 | LADY |
| 63 | 24 | MANZANETA |
| 64 | 24 | SUNRISE |
| 65 | 13 | MISS KELLY RANCH |
| 90 | 26 | CHAPARRAL Q. M. |
| 81 | | BRIGHTON Q M |
| 91 | | FRANCIS ADAMS LODE (SLATE) |

T. 11 N. R. 11 E.

| NO. | SEC. | NAME OF MINE |
|---|---|---|
| 1 | 6 | BLUE LEDGE |
| 2 | 6, 7 | ALHAMBRA |
| 3 | 7 | ATLANTIC |
| 4 | 20 | JENNINGS |
| 5 | 20 | WILFRED |
| 6 | 20, 19 | N EX-JENNINGS |
| 7 | 19 | HOWARD |
| 8 | 31 | GROVER CLEVELAND "LAMONT" |

CALIFORNIA STATE DIVISION OF MINES
WALTER W. BRADLEY, STATE MINERALOGIST

DEPARTMENT OF NATURAL
GEORGE D. NORDENHOL

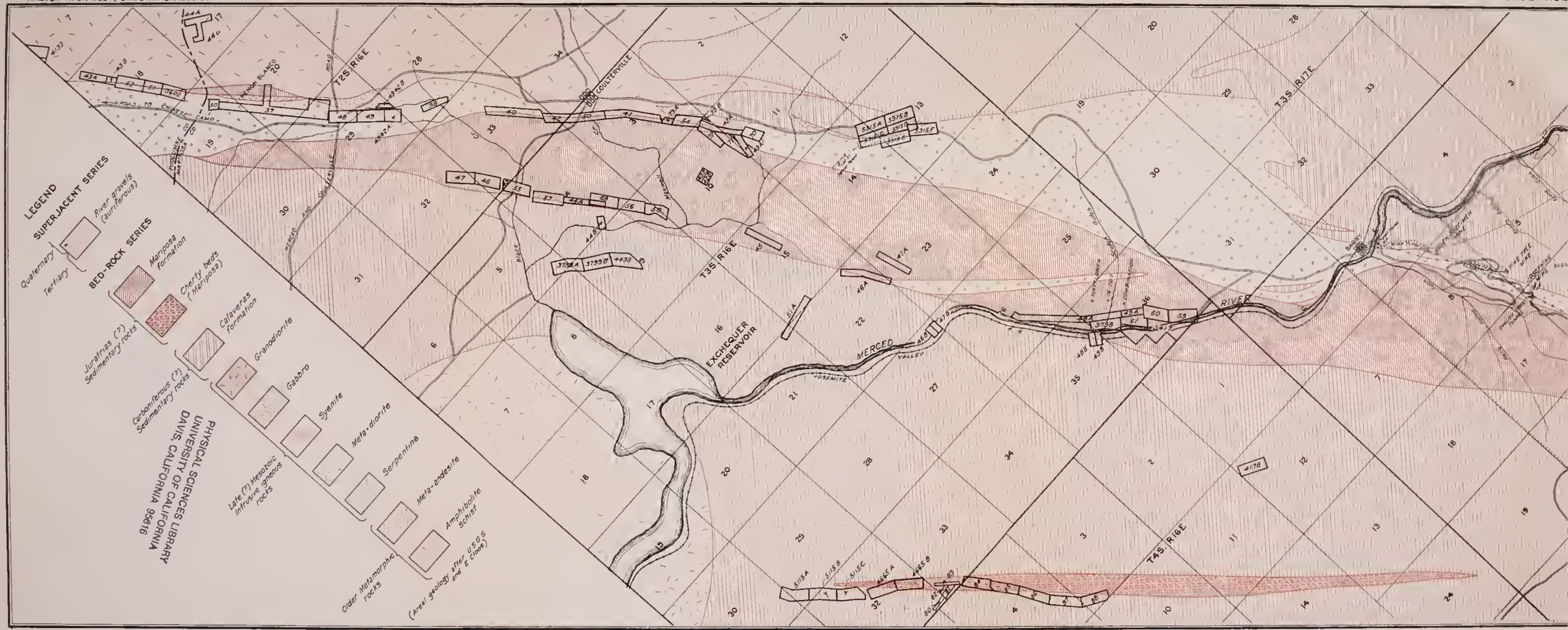

PLATE X

# MAP OF MOTHER LODE GOLD BELT IN MARIPOSA COUNTY SHOWING MINING CLAIMS AND AREAL GEOLOGY 1934

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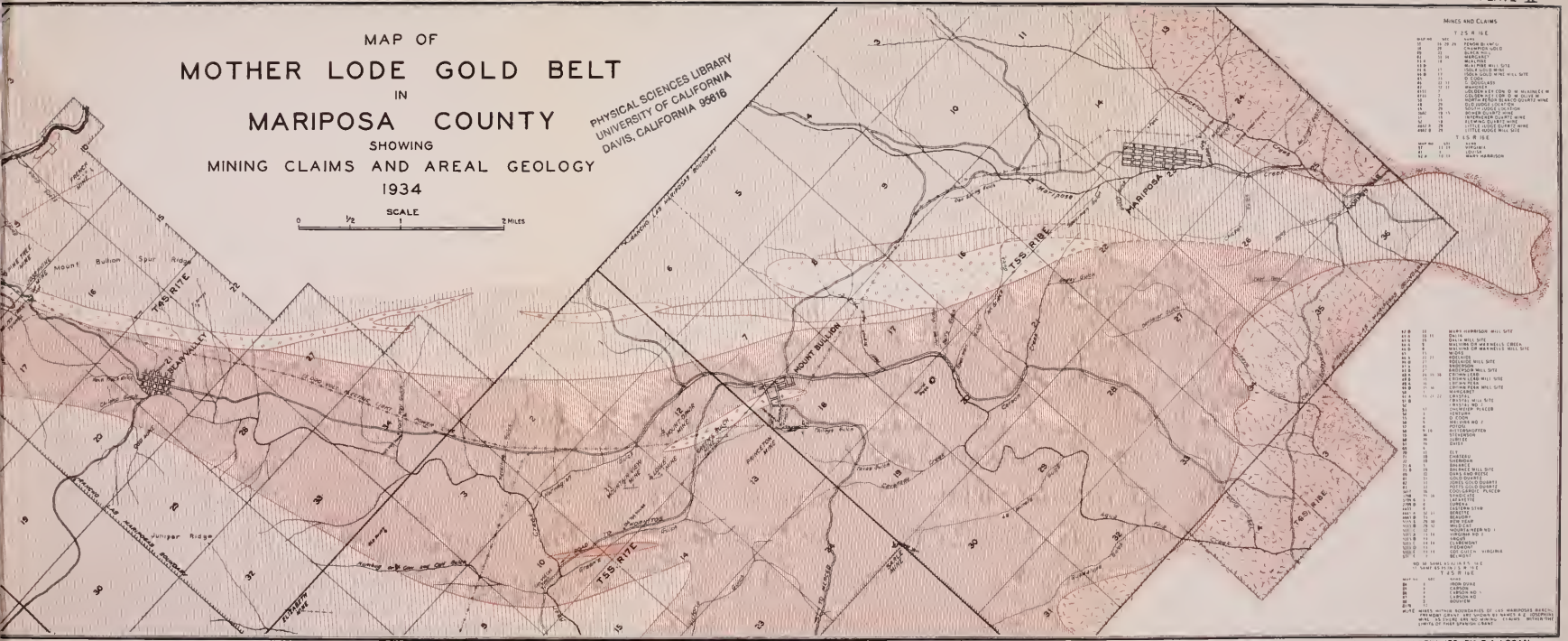

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# MAP OF
# MOTHER LODE GOLD BELT
## IN
# CALAVERAS COUNTY
## SHOWING
## MINING CLAIMS AND AREAL GEOLOGY
## 1934

SCALE
0 1 2 MI.

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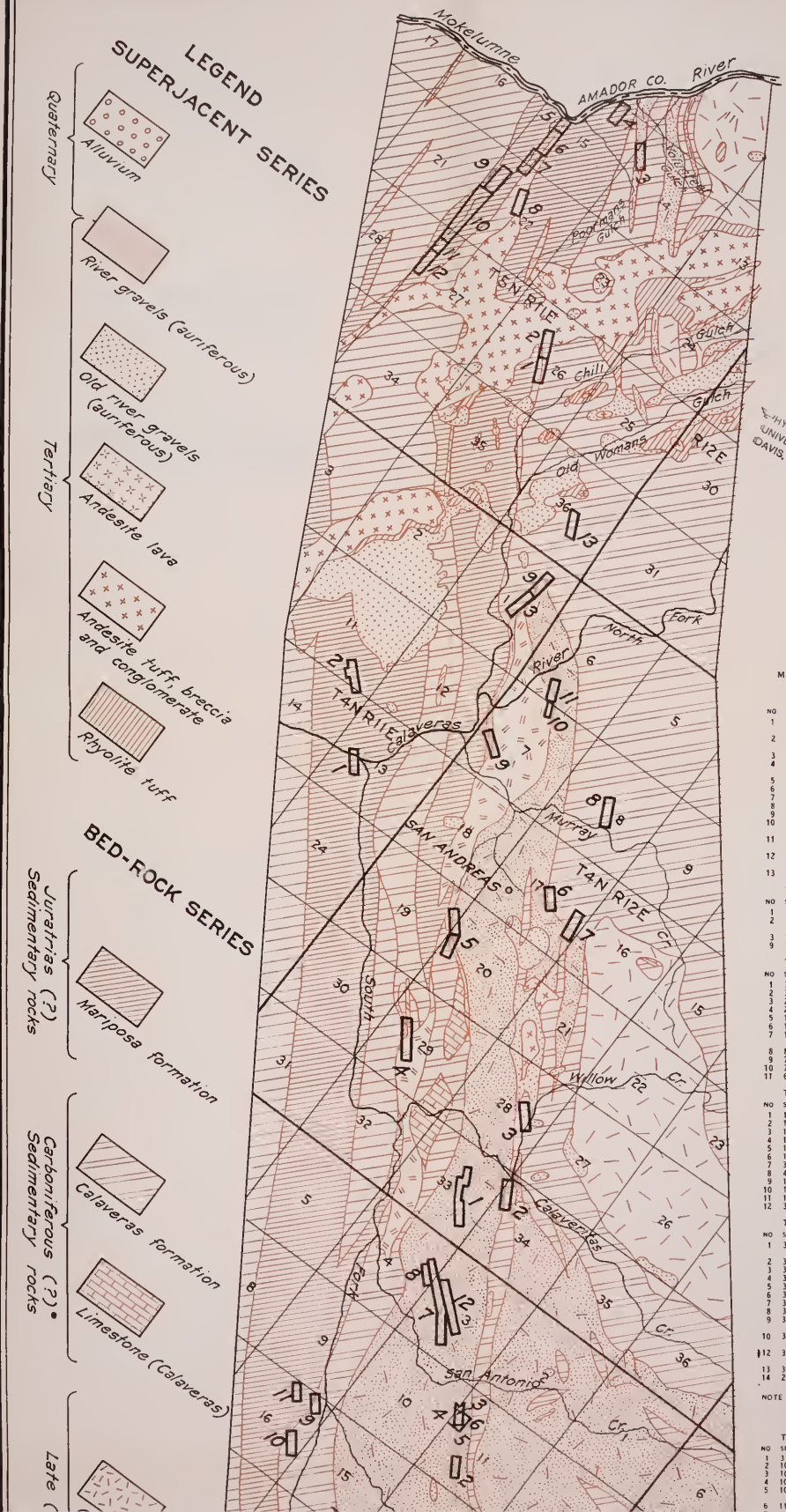


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MINES AND CLAIMS

T 5 N R 11 E

| NO | SEC | NAME |
|---|---|---|
| 1 | 26 | MCNEVIN & MILLSITE |
| 2 | 26 | NO EXT QUAKER CITY |
| 3 | 14 15 | FINCK GOLD |
| 4 | 10, 15 | HANCOCK & TIBBITTS |
| 5 | 15 | BARATTINI |
| 6 | 15 | ONETO |
| 7 | 15 22 | WHITE SWAN |
| 8 | 22 | FLOUR SACK |
| 9 | 27 22 | NORTH PALOMA |
| 10 | 21 22 | |
| | 27 28 | GWIN |
| 11 | 27 28 | SO EXT GWIN NO 1 |
| 12 | 27 | SO EXT GWIN NO 2 |
| 13 | 36 | EDNA O M |

T 4 N R 11 E

| NO | SEC | NAME |
|---|---|---|
| 1 | 13 | NORTH BRANCH |
| 2 | 11 14 | HUDSON & MILLSITE |
| 3 | 1 | GOLDEN HILL |
| 9 | 1 | POCKET HILL |

T 4 N R 12 E

| NO | SEC | NAME |
|---|---|---|
| 1 | 33 | UNION |
| 2 | 33 34 | RATHGEB |
| 3 | 28 | AMBROSIA |
| 4 | 29 | PIONEER CHIEF |
| 5 | 19 20 | EVERLASTING |
| 6 | 17 | FELLOWCRAFT |
| 7 | 17 | MCFALL (OR FORD) |
| 8 | 8 | LEONARO |
| 9 | 7 | GOTTSCHALK |
| 10 | 7 | COMET |
| 11 | 6 9 | GOSPEL |

T. 3 N R 12 E

| NO | SEC | NAME |
|---|---|---|
| 1 | 13 | MALONEY |
| 2 | 11 | THORPE |
| 3 | 10, 11 | BACHMAN |
| 4 | 11 | MIDWINTER |
| 5 | 11 | NATIVE SON |
| 6 | 11 | BIG FOUR |
| 7 | 3 4 | BURGESS |
| 8 | 4 | PEDRO |
| 9 | 16 | DEMAREST |
| 10 | 15 16 | SHOTGUN |
| 11 | 16 | ILLINOIS |
| 12 | 3 | SPECIMEN |

T 3 N R 13 E

| NO | SEC | NAME |
|---|---|---|
| 1 | 33 | GOLD CLIFF & MILLSITE |
| 2 | 33 | LINOSAY |
| 3 | 33 | NALE |
| 4 | 33 | EXTENSION HALE |
| 5 | 33 | SUFFOLK |
| 6 | 33 | DEMOCRAT |
| 7 | 32 | THUNDERBOLT |
| 8 | 32 | GOLD VALLEY |
| 9 | 32 | BLAIR CONS & MILLSITE |
| 10 | 31 32 | COLLINS & RADCLIFF |
| 12 | 31, 30 | OSBORN GOLD HILL |
| 13 | 30 | NO NAME |
| 14 | 29 | CHEROKEE & MILLSITE |

NOTE FOR MINES AT ALTA VILLE & ANGELS SEE SEPARATE MAP PLATE VII

T 2 N R 13 E

| NO | SEC | NAME |
|---|---|---|
| 1 | 3 | BOLITHO |
| 2 | 10 | NO NAME |
| 3 | 10 3 | MARBLE SPRINGS |
| 4 | 10 | BALD HILL |
| 5 | 10 11 | ROMAGGI & COSTA |
| 6 | 11 | G ROMAGGI |

# MAP OF MOTHER LODE GOLD BELT IN AMADOR COUNTY

SHOWING

## MINING CLAIMS AND AREAL GEOLOGY

1934

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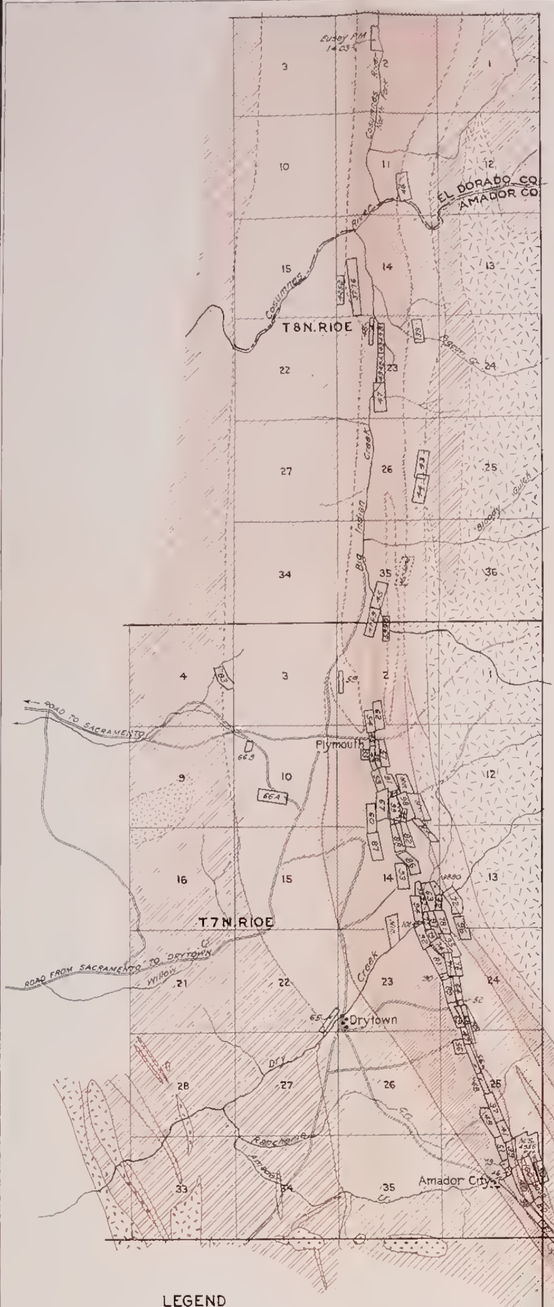



T 8N R 10E

| NO | SEC | NAME |
|---|---|---|
| 35 | 21 | GREAT EASTERN QUARTZ MINE |
| 33 | 26 | CHOSSUS QUARTZ MINE |
| 34 | 26 | ST MARTIN QUARTZ MINE |
| 35 | 35 | ILLINOIS QUARTZ MINE |
| 37 | 23 | EXCELSIOR QUARTZ MINE |
| 38 | 23 | VENTURI GOLD QUARTZ MINE |
| 2376 | 18 | GOLDEN GATE CONS QUARTZ MINE (GOAT RANCH LOC.) |
| 1216 | 18 | GOLDEN GATE CONS. QUARTZ MINE (GOLDEN GATE LOC.) |
| 4252 | 19 | ONONDAGO QUARTZ MINE |
| 4949 A | 21 | CALEDASAN QUARTZ MINE |
| 4949 B | 21 | BRYAN QUARTZ MINE |
| 5040 | 35 | RED STAR QUARTZ MINE |
| 4149 | 35 | GREEN QUARTZ MINE |

T 7N R 10E

| NO | SEC | NAME |
|---|---|---|
| 37 | 25 | MAYFLOWER GOLD QUARTZ MINE |
| 38 | 36 | KEYSTONE GOLD QUARTZ MINE |
| 39 | 36 | ORIGINAL AMADOR GOLD QUARTZ MINE |
| 40 | 36 | SPRINGHILL & GENEVA QUARTZ MINE |
| 41 | 25 | BUNKER HILL |
| 42 | 11 | ONY CREEK |
| 43 | 11 | SIMPSON & ADON |
| 44 | 11 | FORT JOHN |
| 45 | 11 | SOUTHERLAND |
| 46 | 36 | ECLIPSE GOLD |
| 47 | 25 | GOVER |
| 48 | 25 | HAZARD (TREASURE) |
| 49 | 25 | NEVADA |
| 50 | 36 | EL DORADO |
| 51 | 36 | LAST CHANCE |
| 52 | 24 | ITALIAN |
| 53 | 11 | OAKS |
| 54 | 2 | WHEELER |
| 55 | 11 | PHOENIX MILL SITE |
| 56 | 25 | FREMONT QUARTZ MINE & MILL SITE |
| 57 | 11 | REESE (NOW REESE & WOOLFORD NO 1567) |
| 58 | 11 | PHOENIX EAST (NOW 418) |
| 59 | 2 | GREY EAGLE |
| 60 | 11 | NEW LONDON |
| 61 | 36 | SOUTH KEYSTONE |
| 62 | 2 | HARTFORD |
| 63 | 18 | HERCULES |
| 64 | 28 | PEERLESS |
| 65 | 22 | CROWN POINT |
| 66 A | 10 | PLYMOUTH ROCK |
| 66 B | 10 | PLYMOUTH ROCK MILL SITE |
| 67 | 11 | INDIANA |
| 68 | 28 | LOYAL LODE |
| 69 | 28 | NORTH GOVER |
| 70 | 28 | POCLEPOVICH |
| 71 | 28 | MARYLAND |
| 72 | 13 | CENTENNIAL |
| 73 | 36 | ECLIPSE EXTENSION |
| 74 | 23 | CALIFORNIA |
| 75 | 14 | HENRY CLAY |
| 76 | 24 | CHILI JIM |
| 77 | 13 | COSMOPOLITAN |
| 78 | 23 | NORTH CALIFORNIA |
| 80 | 36 | SOUTH SPRING HILL |
| 81 | 23 | POCAHONTAS |
| 82 | 14 | VICTORIA |
| 83 | 4 | OLD OAKER |
| 84 | 14 | BRUCE |
| 87 | 18 | PIONEER |
| 88 | 14 | SHAKESPEARE |
| 89 | 24 | COULTER |
| 90 | 24 | HOMESTAKE |
| 91 | 11 | PLYMOUTH GOLD QUARTZ MINE |
| 92 | 23 | EUREKA NO 1 QUARTZ MINE |
| 93 | 18 | IN QUARTZ MINE |
| 94 | 14 | PROVIDENCE QUARTZ MINE |
| 95 | 24 | WORLEY QUARTZ MINE |
| 96 | 24 | ATLANTIC QUARTZ MINE |
| 97 | 18 | JOE DAVIS QUARTZ MINE |
| 98 | 13 | GIANT QUARTZ MINE |
| 99 | 11 | RED OAK QUARTZ MINE |
| 100 | 36 | NIAGARA QUARTZ MINE |
| 101 | 14 | NORTH EUREKA NO 2 |
| 3591 | 14 | NORTH HENRY CLAY QUARTZ MINE |
| 3880 | 14 | MONITOR QUARTZ MINE |
| 4233 | 11 | RISING STAR FRACTION GROUND DEC 7 47 & 99 |
| 4956 | 36 | MIN SCG PAT |
| 5032 | 36 | NO NAME |

T 6N R 11E

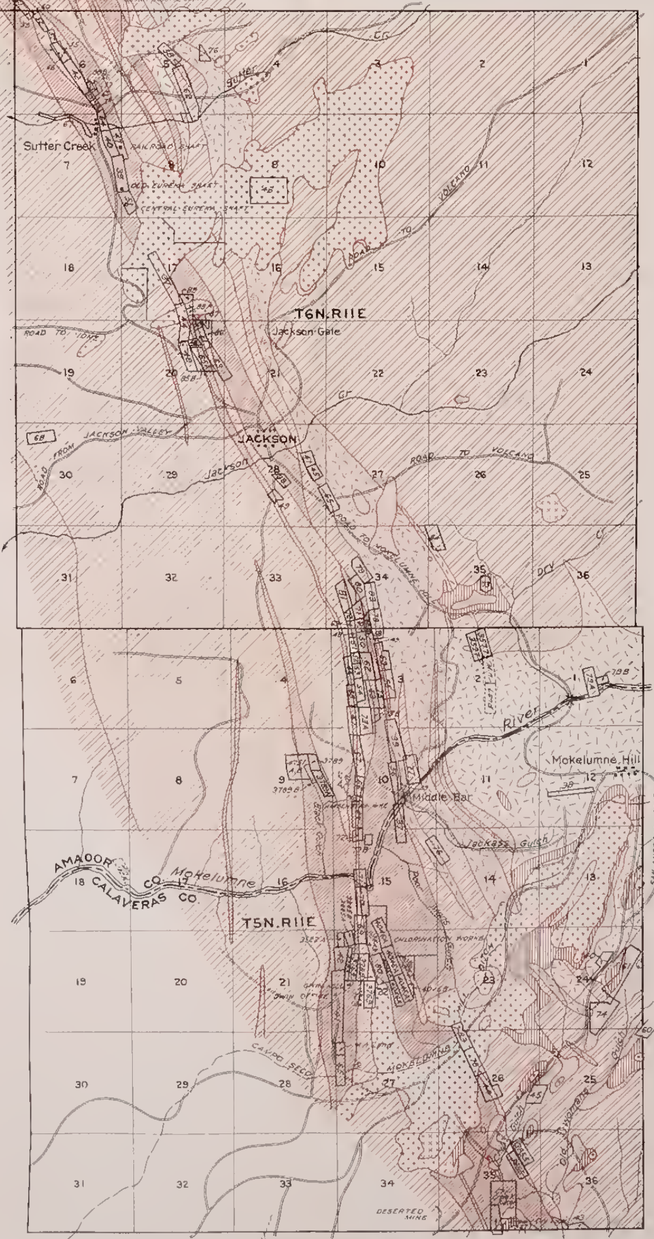
| NO | SEC | NAME |
|---|---|---|
| 37 | 13 | ONEIDA QUARTZ CLAIM |
| 38 | 29 | GOOD HOPE QUARTZ CLAIM |
| 39 | 7 | AMADOR QUARTZ CLAIM |
| 40 | 7 | MAXWELL QUARTZ CLAIM |
| 41 | 28 | BLUE JACKET QUARTZ CLAIM |
| 42 | 6 | LINCOLN QUARTZ CLAIM |
| 43 | 6 | LINCOLN QUARTZ CLAIM SOUTH |
| 44 | 17 | KENNEDY |
| 45 | 28 | ZEILT |
| 46 | 9 | WILD CAT PLACER CLAIM |
| 47 | 3 | GAIL ROAD QUARTZ CLAIM |
| 48 | 20 | PIONEER QUARTZ CLAIM AND MILL SITE |
| 49 | 28 | S BRIGHT |
| 50 | 20 | CLYDE |
| 51 | 4 | SUMMIT |
| 52 | 4 | NORTH STAR |
| 53 | 4 | MAHONEY AND SOUTH MAHONEY QUARTZ |
| 54 | 4 | MAHONEY AND SOUTH MAHONEY QUARTZ |
| 55 | 4 | NORTH LINCOLN QUARTZ |
| 56 | 4 | WINNARD AND MORGAN |
| 57 | 4 | COMET QUARTZ CLAIM |

T 5N R 11E

| NO | SEC | NAME |
|---|---|---|
| 58 | 5 | MECHANICS QUARTZ CLAIM |
| 59 | 4 | SOUTH KEYSTONE QUARTZ CLAIM |
| 60 | 4 | HALSTEAD MILL SITE |
| 61 | 20 | VOLUNTEER COMPANYS QUARTZ CLAIM |
| 62 | 5 | NUMBER ONE AND NUMBER TWO QUARTZ CLAIM AND MILL SITE |
| 63 | 20 | JACKSON QUARTZ CLAIM |
| 64 | 3 | WILDMAN QUARTZ CLAIM |
| 65 | 27 | SUTTER QUARTZ CLAIM |
| 66 | 8 | GOLDEN EAGLE QUARTZ CLAIM |
| 67 | 7 | SCLAVONIA PLACER CLAIM |
| 68 | 30 | MONTE PICHARD QUARTZ CLAIM |
| 69 | 34 | DEWITT QUARTZ CLAIM (FELLOWS & MOULTON) |
| 70 | 34 | DEWITT QUARTZ CLAIM (SYLVESTER & BOSTWICK) |
| 71 | 34 | HALEY QUARTZ CLAIM |
| 72 | 34 | HALEY QUARTZ CLAIM |
| 73 | 35 | AVALA PLACER CLAIM |
| 74 | | SUTTER QUARTZ CLAIM |
| 75 | | MAXIMILIAN QUARTZ CLAIM (OBSOLETE) |
| 76 | 5 | MAXIMILIAN QUARTZ CLAIM |
| 77 | 5 | CAPITOL QUARTZ CLAIM AMENDMENT MADE NOV 15 1882 (CONFLICT WITH HUBBARD & MCADAMS) |
| 78 | 34 | AMADOR QUEEN NO 1 QUARTZ CLAIM |
| 79 | 34 | AETNA QUARTZ MINE |
| 80 | 34 | ISAAC NEWTON QUARTZ MINE |
| 81 | 34 | LAW LOTTIER QUARTZ MINE |
| 82 | 34 | DEWITT MILL SITE |
| 83 | 34 | DOYLE QUARTZ MINE |
| 84 | 34 | ALPI QUARTZ MINE |
| 85 A | 20 | MULDOON QUARTZ MINE |
| 85 B | 20 | MULDOON MILL SITE |
| 86 | 20 | SILVA QUARTZ MINE |
| 87 | 20 | GOLDEN GATE QUARTZ |
| 88 A | 17 | CLYDE QUARTZ MINE IN SEC 17 |
| 89 | 17 | PENDOLA PLACER MINE |
| 90 B | 4 | SURVEY 1215 STEWART & M IN SEC 4 (AMENDMENT) |

T 5N R 11E

| NO | SEC | NAME |
|---|---|---|
| 37 | 10 | HANCOCK & TIBBITS QUARTZ MINE |
| 38 | 12 | UNION COMPANYS QUARTZ CLAIM |
| 39 | 10 | HARDENBERGH QUARTZ MINE |
| 40 | 28 | CHILI GULCH FLUMING CO'S PLACER MINE |
| 41 | 22 | GWIN QUARTZ MINE |
| 42 | 22 | NORTH PALOMA QUARTZ MINE |
| 43 | 34 | WILLIAMS & HEWES PLACER |
| 44 | 24 | MACNEVIN QUANTZ MINE |
| 45 | 24 | PELLETON PLACER MINE |
| 46 | 3 | EMPIRE QUARTZ MINE |
| 47 | 3 | VALPARAISO QUARTZ MINE |
| 48 | 3 | DEWITT QUARTZ MINE (FELLOWS & MOULTON) |
| 49 | 3 | DEWITT QUARTZ MINE (SYLVESTER & BOSTWICK) |
| 50 | 3 | DEWITT QUARTZ MINE (LOVERIDGE & LOCKWOOD) |
| 51 | 3 | DEWITT QUARTZ MINE (INGALS) |
| 52 | 3 | DEWITT QUARTZ MINE (LEAVITT) |
| 53 | 3 | DEWITT QUARTZ MINE (SYLVESTER & BRIGGS) |
| 54 | 3 | DEWITT QUARTZ MINE (MAHONET & HALL) |
| 55 | 3 | VAUGHN QUARTZ MINE |
| 56 | 10 | SARGENT QUARTZ MINE |
| 57 | 10 | MAMMOTH GOLD QUARTZ MINE |
| 58 | 3 | AMADOR QUEEN NO 1 QUARTZ MINE |
| 59 | 3 | KRUGER QUARTZ MINE |
| 60 | 25 | EMPIRE GRAVEL MINE |
| 61 | 24 | GREEN MOUNTAIN PLACER MINE |
| 62 | 3 | MCKAY & LOVE QUARTZ MINE |
| 63 | 3 | KELLY GOLD QUARTZ MINE |
| 64 | 3 | DEWITT MILL SITE |
| 65 | 27 | SOUTH EXTENSION NO 2 GWIN QUARTZ MINE |
| 66 | 10 | ST JULIAN QUARTZ MINE |
| 67 | 10 | MARLETTE QUARTZ MINE |
| 68 | 3 | MINERAL POINT QUARTZ MINE |
| 69 | 15 | WHITE SNOW QUARTZ MINE |
| 70 | 15 | ONEYO QUARTZ MINE |
| 71 | 15 | BARATELNI QUARTZ MINE |
| 72 A | 15 | MCKINNEY & CRANNIS QUARTZ MINE |
| 72 B | 15 | MCKINNEY & CRANNIS MILL SITE |
| 73 A | 3 | WETZLER QUARTZ MINE |
| 73 B | 3 | WETZLER MILL SITE |
| 74 | 24 | ROUGH DIAMOND TUNNEL PLACER MINE |
| 75 | 3 | KELLY MILL SITE |
| 76 | 14 | FINK GOLD QUARTZ MINE |
| 77 | 10 | MIDDLE BAR QUARTZ MINE |
| 78 | 24 | NORTH EXTENSION OF QUAKER CITY QUARTZ MINE |
| 79 A | 3 | KEARSING QUARTZ MINE |
| 79 B | 3 | KEARSING MILL SITE |
| 80 | 22 | FLOUR SACK QUARTZ MINE |
| 81 | | VULTURE & MCNAMARA CONS Q M VULTURE LOCATION |
| 82 | | VULTURE & MCNAMARA CONS Q M PRICE & MCNAMARA LOC |
| 83 | 24 | HAMBY QUARTZ MINE |
| 3142 A | | GOOD HOPE QUARTZ MINE |
| 3391 | 22 | GWIN MILL SITE |
| 3749 | 22 | QUEEN CONS MG CLAIM (STEM WINDER LOCATION) |
| 3749 | 22 | QUEEN CONS MG CLAIM (QUEEN LOCATION) |
| 3749 | 22 | QUEEN CONS MG CLAIM (MESSENGER) |
| 3789 | 9 | ACME CONS Q M & MILL SITE (TIGER LOCATION) |
| 3789 A | 9 | ACME CONS Q M & MILL SITE (ACME LOCATION) |
| 3789 B | 9 | ACME CONS Q M & MILL SITE (ACME MILL SITE) |
| 1855 | 35 | OPHIR MOUNTAIN CONS Q M |
| 3883 | 22 | LEONID CONS PLACER MINE (TRACTS A B C D) |
| 3883 A | 22 | VICTOR QUARTZ MINE |
| 3883 B | 22 | VICTOR MILL SITE |
| 4044 A | 22 | (5 CLAIMS) FLOUR SACK CONS Q M (VIRGINIA CLAIM) |
| 4044 A | 22 | FLOUR SACK CONS Q M (OCCIDENTAL CLAIM) |
| 4044 A | 22 | FLOUR SACK CONS Q M (CALIFORNIA CLAIM) |
| 4044 A | 22 | FLOUR SACK CONS Q M (CROWN POINT CLAIM) |
| 4044 A | 22 | FLOUR SACK CONS Q M (KEY STONE CLAIM) |
| 4044 B | 22 | FLOUR SACK CONS Q M (CALIFORNIA MILL SITE) |
| 4791 A B | 9 | NEW YEARS CONS LODE AND MILL SITE |




## LEGEND

### SUPERJACENT SERIES

Quaternary

- Alluvium
- River gravels (auriferous)
- Old river gravels (auriferous)

Tertiary

- Andesite lava
- Andesite tuff, breccia and conglomerate
- Rhyolite tuff

### BED-ROCK SERIES

Jurassic (?) Sedimentary Rocks

- Mariposa formation

Carboniferous (?) Sedimentary Rocks

- Calaveras formation

Late (?) Mesozoic Intrusive Igneous Rocks

- Gabbro
- Meta-diorite
- Serpentine

Older Metamorphic Rocks

- Meta-andesite
- Amphibolite schist

(Areal geology after U.S.G.S.)

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CALIFORNIA STATE DIVISION OF MINES
WALTER W. BRADLEY, STATE MINERALOGIST

DEPARTMENT OF NATURAL RESOURCES
GEORGE D. NORGENHOLT, Director

PLATE VIII

# MAP OF MOTHER LODE GOLD BELT IN TUOLUMNE COUNTY

SHOWING

## MINING CLAIMS AND AREAL GEOLOGY

1934

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SCALE

0 1 2 3 4 5 MILES

T 2 N R 13 E

| MAP NO. | SEC. | NAME |
|---|---|---|
| 52 A | 25 | BOWN |
| 52 B | 25 | BOWN M S |
| 53 B | 25 | GULLIS & CARRINGTON M S |

T 2 N R 14 E

| MAP NO. | SEC. | NAME |
|---|---|---|
| 17 | 32 | ARABIAN Q M |
| 60 A | 30 | WATERS Q M (ATLAS MINE) |
| 60 B | 30 | WATERS M |
| 61 | 29 | VALPARAISO Q M & M S |
| 61 | 29 | VALPARAISO Q M |
| 43 | 36 | FAIRVIEW Q M |
| 44 | 36 | LENNAN Q M |
| 45 | 30 | GULLIS & CARRINGTON Q M |
| 46 | 31 | GULLIS & CARRINGTON M S |
| 47 | 33 | TARANTULA Q M |
| 48 | 33 | TARANTULA M |
| 49 | 13 | PROSPECT Q M |
| 50 | 28 | GRAND TURK Q M |
| 51 A | 32 | GILLIS & CARRINGTON |
| 54 | 25 | MENEAN Q M |
| 57 | 32 | Q R Q M |
| 58 | 25 | MATHAWAY PLACER |
| 59 | 32 | MATHAWAY Q M |
| 60 | 32 | V H & Q R Q M |
| 61 | 18 | MONTREAL CONS Q M |
| 62 | 18 | MONTREAL CONS |
| 63 | 18 | MONTREAL CONS |
| 64 | 18 | MONTREAL CONS |
| 66 | 30 | SOLDIERS GULCH |
| 67 | 30 | SOLDIERS GULCH Q M |
| 68 | 30 | NORWEGIAN CONS Q M |
| 68 A | 30 | NORWEGIAN CONS M S |
| 69 | 30 | NORWEGIAN CONS GOLDEN RULE Q M |
| 69 A | 30 | NORWEGIAN CONS GOLDEN RULE M S |
| 70 | 30 | NORWEGIAN CONS SPOT CASH Q M |
| 71 | 30 | MAGRUDER Q M |
| 72 | 30 | WILSON Q M |
| 73 | 30 | WILSON & MEANS Q M |
| 74 | 25 | JOHN ROYAL Q M |
| 76 | 31 | KAISER Q M |
| 147 | 13 | WOLFE & CO PLACER |
| 316 | 19 | GOLD SPRING PLACER |
| 3419 | 4 | DENSMORE CONS Q M & M S |
| 3426 | 29 | SCHULER & CO Q M |
| 3429 | 29 | THOM S SCHULER Q M |
| 3430 | 29 | OLD TUOLUMNE GROUP Q M |
| 3736 | 32 | MOUNTAIN VIEW CONS Q M |
| 3767 | 21 | LEAD & TAM Q SHANTER CONS Q M |
| 3778 | 30 | BILL Q M |
| 3805 | 29 | GROSS CONS Q M |
| 3854 | 29 | GALLOWAY Q M |
| 3858 | 25 | GALLOWAY M S |
| 4109 | 29 | GOOSE NEST Q M |
| 4124 | 24 | GOOD LUCK Q M |
| 4378 | 32 | MAGRUYATT Q M |
| 4412 | 31 | TOLEDO CONS Q M |
| 4460 | 29 | ALTA Q M |
| 4961 | 29 | ARTHAHASSE Q M |
| 5002 A | 32 | WICKHAM Q M |
| 5002 B | 32 | WICKHAM M S |
| 5018 | 30 | RELIEF & SURPLUS Q M |
| 5048 | 19 | JUSTICE Q M |
| 5133 | 32 | B F GANDY & LITTLE BOY Q M |
| 5261 | 31 | BUENA VISTA & BUENA VISTA NO 1 Q M |
| 5264 | 31 | JACKSON FLAT & PARALLEL Q M (CARDINELLE) |
| 5276 | 25 | SPRING HILL Q M |
| 5374 | 25 | SPRING HILL M S |
| 5812 | 28 | LITTLE LEO Q M |
| 5862 | 32 | NUT PINE Q M |
| 5862 B | 32 | NUT PINE M S |
| 3774 | 31 32 | MTN VIEW CONS (GOLD LEAF & MTN VIEW) |

T 1 N R 14 E

| MAP NO. | SEC. | NAME |
|---|---|---|
| 35 | 16 | TRIO Q M |
| 38 | 18 | MCCANN Q M |
| 39 | 22 | HITCHCOCK Q M |
| 40 | 22 | GREY EAGLE Q M |
| 41 | 22 | CRYSTALLINE Q M |
| 42 | 29 | PLACER MINE |
| 43 | 21 | ALPHA & OMEGA COPPER |
| 44 | 22 | SPPO M & M S |
| 45 | 22 | SWEENEY Q M & M S |
| 46 | 9 | RAWHIDE NO 2 Q M & M S |
| 47 | 5 | ALAMEDA |
| 48 | 8 | PADICAH PLACER |
| 49 | 9 | RAWHIDE PLACER |
| 50 | 9 | MONKEY FLAT M S |
| 51 | 3 | CHILCOOT CONS Q M GRAVEL |
| 52 | 3 | GOLDEN RULE Q M & M S |
| 53 | 8 | HOA BLANCO Q M & M S |
| 54 A | 22 | NESLEP Q M |
| 54 B | 22 | NESLEP M S NO 1 |
| 54 C | 22 | NESLEP M S NO 2 |
| 55 A | 22 | DUTCH Q M |
| 55 B | 22 | DUTCH M S |
| 56 | 22 | KNOX LA LA Q M |
| 57 | 22 | KNOX & BOYLE Q M |
| 58 | 22 | KNOX & BOYLE Q M |
| 59 | 18 | MAZEPPA Q M |
| 60 A | 9 | RAWHIDE Q M |
| 60 B | 9 | RAWHIDE M S |
| 61 | 9 | CRYSTALLINE Q M |
| 62 | 9 | CRYSTALLINE M S |
| 63 | 9 | ALABAMA CONS Q M |
| 65 | 9 | ALABAMA CON M S |
| 66 | 9 | OMEGA Q M |
| 66 | 9 | SHORE Q M |
| 67 | 15 | ISABELLA & GEM Q M |
| 68 A | 22 | MILLER & HOLMES Q M |
| 68 B | 22 | MILLER & HOLMES M S |
| 69 | 22 | TABLE MT ALPHA GRAVEL |
| 70 | 35 | JUMPER Q M |
| 71 A | 27 | ERIN GO BRAUGH Q M |
| 71 B | 27 | ERIN GO BRAUGH M S |
| 72 | 15 | PACIFIC Q M |
| 75 | 5 | PAPPAHANNOCK Q M |
| 76 | 1 | GOLDEN GATE Q M |
| 77 | 1 | GOLDEN GATE SULPHURET Q M |
| 78 A | 24 | SOUTH Q M |
| 79 A | 5 | CRYSTALLINE Q M |
| 79 B | 9 | SEEGER MILL SITE |
| 80 | 27 | CLOUDMAN Q M |

T 1 N R 14 E

| MAP NO. | SEC. | NAME |
|---|---|---|
| 81 | 9 | CRYSTALLINE Q M NO 2 |
| 82 | 9 | CRYSTALLINE Q M NO 3 ORIAR |
| 83 | 16 | VULTURE Q M |
| 84 | 25 | NO 1 |
| 85 | 22 | NYMAN Q M NO 1 |
| 86 | 22 | NYMAN CON Q M NO 2 |
| 87 | 7 | SARAH FRANCIS Q M |
| 88 | 6 | LUCKY STAR Q M & M S |
| 89 | 6 | BADGER Q M |
| 162 | 15 | NEWCOMB Q M |
| 163 | 15 | BUCKEYE M CO |
| 164 | 15 | GILCO Q M |
| 165 | 12 | PIONTER Q M |
| 166 | 25 | MEXICAN Q M |
| 479 | 9 | BLUE JACKET PLACER |
| 836 | 13 | MARLBOROUGH PLACER |
| 3563 A | 7 | S EX GOLDEN GATE SULPHURET Q M |
| 3563 B | 7 | S EX GOLDEN GATE SULPHURET M S |
| 3568 | 5 | JUNIETTA Q M |
| 3569 | 9 | MEXICAN FLAT PLACER |
| 3644 | 18 | SUBRANTE Q M |
| 3651 | 1 | FISHER BENLOW & EX PLACER |
| 4151 | 1 | GERRYMANDER CON Q M |
| 5001 | | CHANTEREAU Q M |
| 5421 | 28 | MARCELLA Q M |
| 5761 | 1 2 | MARIANITA Q M |

T 1 S R 14 E

| MAP NO. | SEC. | NAME |
|---|---|---|
| 17 | 13 | MAMMOTH Q M |
| 18 | 11 | MAMMOUT Q M |
| 19 | 11 | EAGLE Q M |
| 19 A | 13 | REPUBLICAN Q M |
| 20 | 13 | ORCUTT Q M |
| 21 | 2 | BELLA UNION Q M |
| 22 | 2 | LONE STAR Q M |
| 23 | 2 | BROWN BEAR Q M |
| 24 | 2 | ALBION CON Q M GREAT EASTERN CL |
| 25 | 2 | ALBION CON Q M FARRINGTON |
| 26 | 2 | ALBION CON Q M DEFENDER |
| 27 | 2 | ALBION CON Q M BOB |
| 28 | 2 | ALBION CON Q M HARD TACK |
| 29 | 12 | HOMESTAKE Q M |
| 30 | 11 | BLUE GULCH P M |
| 3719 | 11 | BIRD PLACER |
| 3720 | 2 | SHANNON CREEK PLACER |
| 3820 | 2 | MAMMOTH PLACER |
| 4317 | 11 | ROSENFELD CON Q M |
| 4319 | 11 | HECTOR PLACER |
| 4320 | 13 | RAYMON Q M |
| 4437 | 2 | NUGGET Q M |
| 4882 | 3 | MOUNTAIN VIEW Q M |
| 4911 | 2 | MOUNTAIN VIEW EXTENSION Q M |
| 4912 | 2 | HANNAH JESS M |
| 4913 | 2 | TARANTULA HAWK Q M |
| 4931 | 2 | BOULDER DEEP & GOLDEN HORSESHOE Q M |
| 5756 | 2 | LULU JANE & POOR SINNER Q M |

T 1 S R 15 E

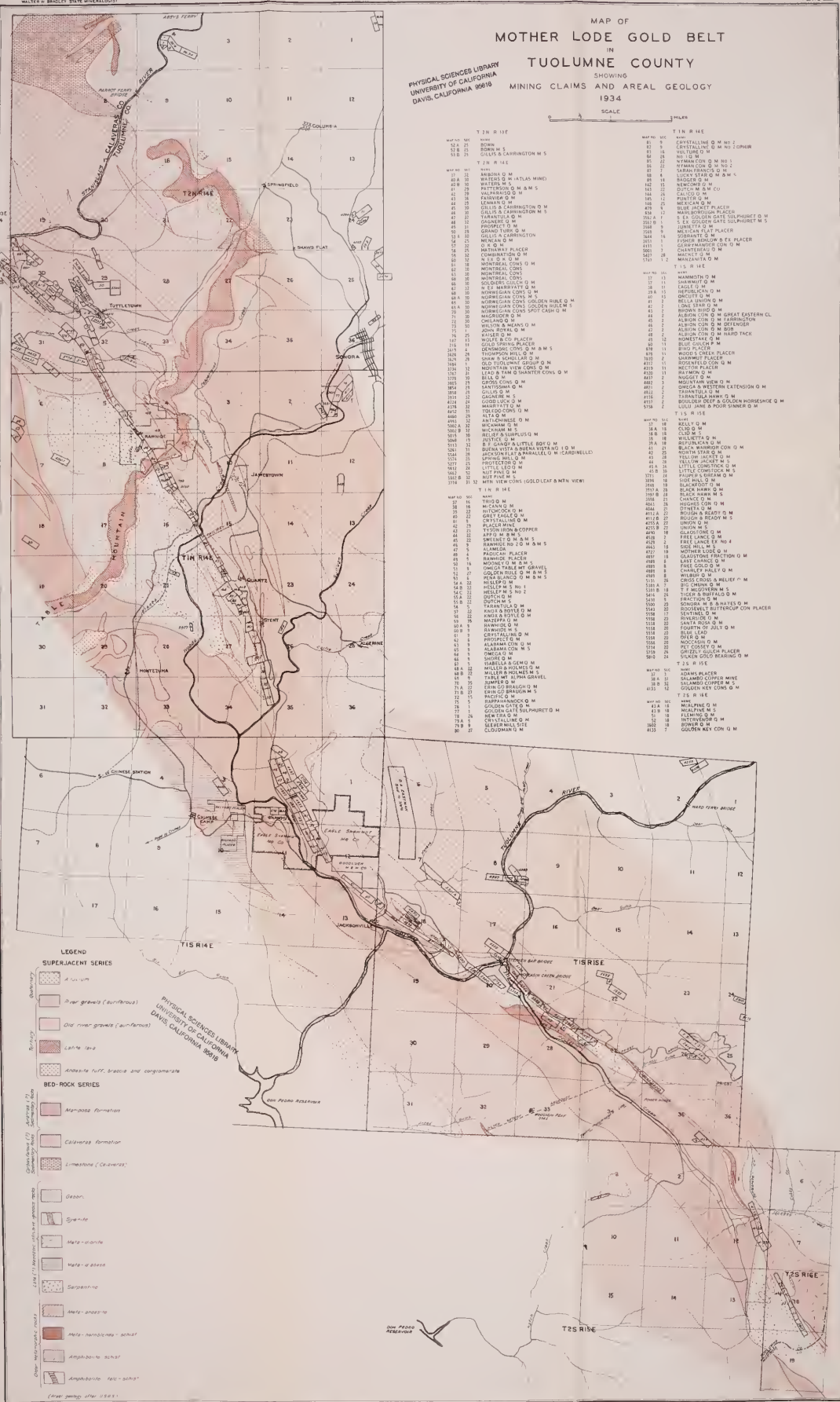
| MAP NO. | SEC. | NAME |
|---|---|---|
| 17 | 18 | KELLY Q M |
| 18 A | 18 | CLIO Q M |
| 18 B | 18 | CLIO M S |
| 18 | 18 | WILLIETTA Q M |
| 19 A | 18 | REPUBLICAN Q M |
| 41 | 21 | BLACK WARRIOR CON Q M |
| 42 | 21 | BLACK HAWK Q M |
| 43 | 28 | YELLOW JACKET Q M |
| 44 | 28 | YELLOW JACKET M S |
| 45 A | 34 | LITTLE COMSTOCK Q M |
| 45 B | 34 | LITTLE COMSTOCK M S |
| 3711 | 28 | PHILIPPI'S BIRDAN Q M |
| 3896 | 18 | SIDE WALL Q M |
| 3897 | 18 | SIDE WALL M S |
| 3959 A | 28 | BLACK HAWK Q M |
| 3959 B | 28 | BLACK HAWK M S |
| 3958 | 21 | CHANCE Q M |
| 4063 | 34 | HUGHES CON Q M |
| 4066 | 21 | O'NEETA Q M |
| 4112 A | 22 | ROUGH & READY Q M |
| 4112 B | 22 | ROUGH & READY M S |
| 4295 A | 27 | UNION Q M |
| 4295 B | 27 | UNION M S |
| 4490 | 18 | GLADSTONE Q M |
| 4528 | 2 | FREE LANCE Q M |
| 4529 | 2 | FREE LANCE EX NO 4 |
| 4663 | 18 | SIDE HILL Q M |
| 4664 | 18 | SIDE HILL M S |
| 4851 | 19 | GLADSTONE FRACTION Q M |
| 4889 | 8 | LAST CHANCE Q M |
| 4889 | 8 | FREE GOLD Q M |
| 4889 | 8 | CHARLEY HALEY Q M |
| 4889 | 8 | WILBUR Q M |
| 5131 | 28 | CRISS CROSS & RELIEF Q M |
| 5181 A | 28 | P P SMITH Q M |
| 5181 B | 28 | P P SMITH M S |
| 5438 | 26 | TIGER & BUFFALO Q M |
| 5438 | 5 | ERACTION Q M |
| 5590 | 29 | SONORA M B & HAYES Q M |
| 5543 | 20 | ROOSEVELT BUTTERCUP CON PLACER |
| 5558 | 17 | SENTINEL Q M |
| 5558 | 22 | RINKERHOFF Q M |
| 5558 | 22 | SAMPSON Q M |
| 5558 | 20 | SOUTH ON JOLT Q M |
| 5558 | 20 | BLUE LEAD |
| 5558 | 20 | OFER Q M |
| 5558 | 29 | NOCCASIN Q M |
| 5734 | 20 | PET COSSEY Q M |
| 5758 | 24 | GRIZZLY GULCH PLACER |
| 5810 | 24 | SILKEN GOLD BEARING Q M |

T 2 S R 15 E

| MAP NO. | SEC. | NAME |
|---|---|---|
| 17 | 5 | ADAMS PLACER |
| 18 A | 31 | SALAMBO COPPER MINE |
| 18 B | 32 | SALAMBO COPPER M S |
| 4151 | 12 | GOLDEN KEY CONS Q M |

T 2 S R 14 E

| MAP NO. | SEC. | NAME |
|---|---|---|
| 43 A | 18 | MCALPINE Q M |
| 43 B | 18 | MCALPINE M S |
| 51 | 18 | FLEMING Q M |
| 52 | 18 | INTERVIEWER Q M |
| 3602 | 18 | BOWER Q M |
| 4133 | 7 | GOLDEN KEY CON Q M |

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